IE407 Total Quality Management
Lecture 24

Instructor: Dr. Ali Ahmad

Reminder: SA grade

- SA grade will be determined by the attendance system
- More than 8 absents will automatically lead to SA grade
- Please be careful about your attendance in lectures

Besterfield Chapter 7: Performance Measures

Cost of Quality

Categories of Quality Related Costs

- Four primary quality cost categories
  - Internal failure costs
  - External failure costs
  - Appraisal costs
  - Prevention costs

Internal Failure Costs

- These are costs which are associated with the defects or non-conforming situations that are found prior to shipment of the product to customer
  - Such situations are salvaged by either rework, complete replacement or scrapping
- The total cost of carrying out re-inspection/re-test, failure analysis, evaluation, disposition and subsequent actions are included in the internal failure cost
- In summary, this includes all material, labor, energy and overhead expenses that are wasted on account of non-conforming or defective product or service

Internal Failure Costs - 2

- Examples of internal failure costs are:
  - Rework, fixing of bugs detected in internal testing of software
  - Premium freight due to late delivery
  - Internal scrap
  - Engineering and drawing changes to correct errors
  - Energy cost for re-melting of rejected castings

External Failure Costs

- External failure costs are the costs incurred when defects are discovered after the product reaches the dealer or customer
- Examples of external failure costs:
  - Complaints:
    - Complaints from customer are analyzed, resolved and communication is sent to customer
    - Sometimes it may also involve field service or adjustments
  - Liabilities and penalties:
    - Insurance claims and contractual obligatory claims are included in such types of costs

External Failure Costs - 2

- Examples of external failure costs: (continued)
  - Warranty claims:
    - Recall of vehicles for defects, costs involved in repairs or replacement of product during warranty period
    - The cost associated with receipt, evaluation and replacement of defective product from field
  - Retrofit and recall costs:
    - It is often required to modify or update the product in order to incorporate new design changes in order to overcome design deficiencies
    - There are several cases in recent past, where automobiles were recalled due to failure investigation reports on the steel used in the manufacturing

External Failure Costs - 3

- Examples of external failure costs: (continued)
  - Allowances and customer goodwill:
    - The cost of concessions offered to the customer due to substandard product, poor quality or costs incurred because the customer is not completely satisfied with the quality because his expectations were higher than those delivered to him by the product
- External failure costs will also include lost sales and loss of goodwill although these are difficult to measure

Appraisal Costs

- These are costs incurred while conducting inspection, tests, and several other planned evaluations
  - These are done to determine whether the product (or service) conforms to its stated requirements
  - Appraisal costs also includes
    - Various activities related to quality system audit
    - Cost of legal compliance
    - Supplier surveillance
    - Product quality audits
    - Costs for calibration of testing equipment

Appraisal Costs - 2

- Thus, cost of maintaining the inspection and test equipment is a part appraisal cost
  - Examples include:
    - Design reviews
    - Software testing
    - Set-up inspection
    - Performance testing by customer, calibration of gauges
    - Calibration of testing facility
    - Receiving inspection of purchased parts

Prevention Costs

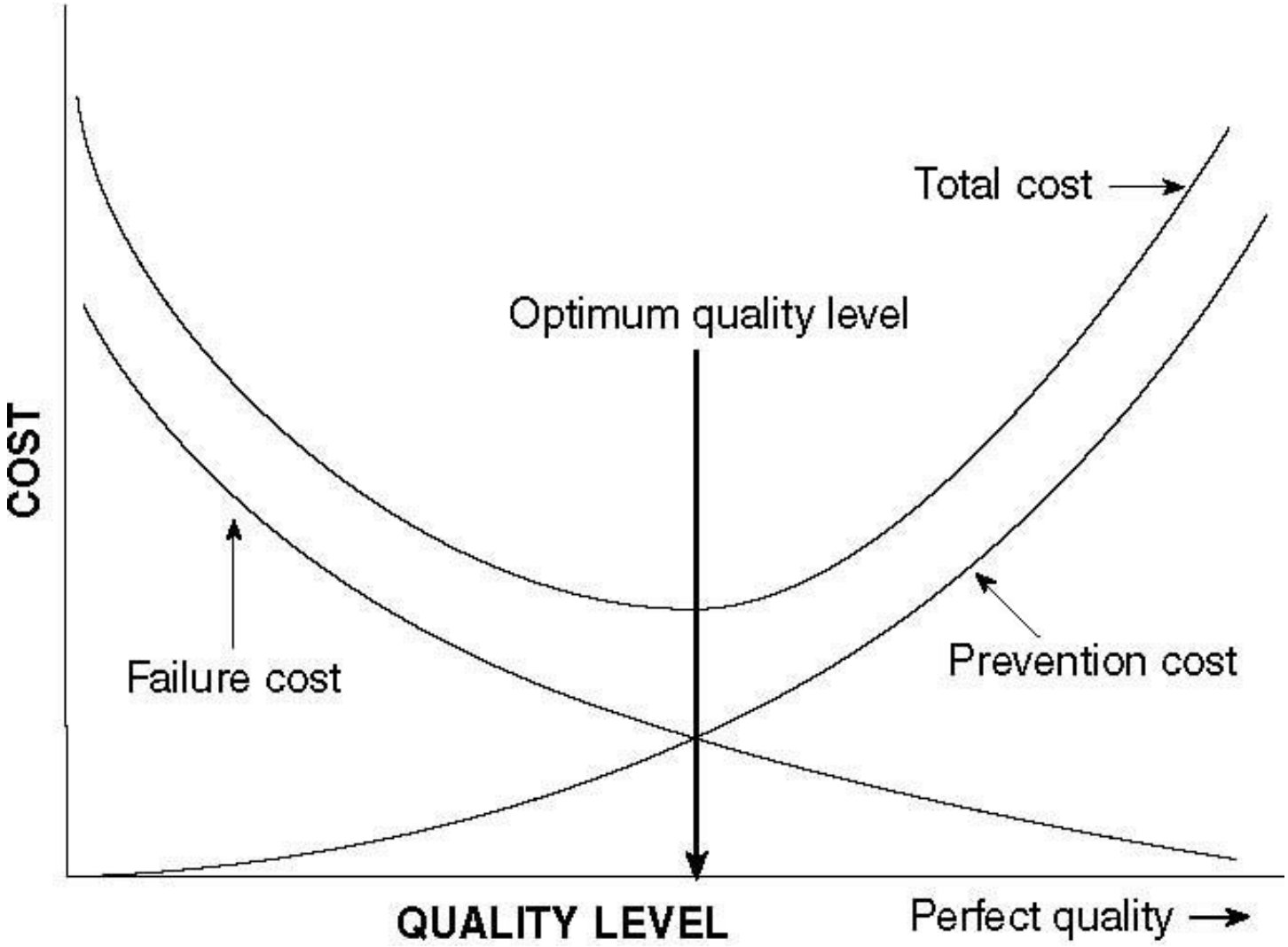
- These are the costs of all such activities undertaken to prevent defects in design, development, purchase, labor and other aspects of creation of the product/service
- Prevention costs lower the other costs (failure cost and appraisal cost)
- Prevention is achieved by examining previous failure data and developing action plans for incorporating into the basic system so that the same failures/defects do not occur again

Prevention Costs - 2

- Examples of prevention costs include:
  - Staff training
  - Product quality planning
  - Design FMEA and process FMEA
    - FMEA = failure mode and effects analysis
  - Tolerance analysis before design release
  - Computer aided design and analysis
  - Process capability study for process qualification
  - Part selection for better reliability
  - Designed experiment for optimum settings of the product

Total Cost of Quality

- Total cost of quality is the addition of all the four categories
  - It is often expressed as percent of sales
- Figure on the next slide shows a broad-level relationship between cost of (prevention+appraisal) and failure costs
  - There is a quality level at which the total cost of quality is minimum



Classical model of optimum quality costs. From *Jurans Quality Control Handbook, 4th edition*. J.M. Juran, editor. Copyright © 1988, McGraw-Hill.

Source: http://qualityamerica.com/LSS-Knowledge-Center/qualitymanagement/goal_of_quality_cost_system.php

Total Cost of Quality - 2

- However, the quality level for minimum cost has been challenged by Six Sigma professionals
- They argue that the achieving the five or six sigma level of performance dramatically reduce cost of appraisal and prevention
  - Reference: Six Sigma Breakthrough Management Strategy Revolutionizing World's Top Corporations by Michael Harry and Richard Schroeder published by Doubleday, New York in 2000

Data Collection and Reporting

Data Collection and Reporting

- Normally accountants are charged with the responsibility of collecting cost data
- But accountants may not have sufficient understanding of quality related concepts to be able to determine cost of poor quality
- Therefore, quality manager and accountant should work closely together to collect data on cost of poor quality
  - Quality manager should compile data in accounting format and present it to management to identify quality issues
  - Cost data will have maximum impact as it speaks the language of money which management understands best

Data Collection and Reporting - 2

- A task force appointed for measuring cost of quality should propose a system of data collection consisting of
  - A list of cost categories for accumulating quality related costs
  - Identification of responsibilities for data collection
  - A schedule for data collection
- Management should ensure that the activities specified in the system are carried out as prescribed
- Data may be collected either by estimation or by detailed recording of actual costs
- Estimation may be adequate in the early stages because it takes less time and may help in identification of opportunities for substantial cost savings

Data Collection and Reporting - 3

- Detailed and accurate costs my be obtained either from established accounts or from an analysis of different expenditures
- A change in existing accounting system may be needed to record the breakup of expenditures that are currently recorded as lump sum
- Some quality cost data crosses the departmental boundaries and requires a detailed study
  - For example, scrap and rework costs may involve many departments

References

- Besterfield, Dale H. and others. 2019. *Total Quality Management,* 5th edition. Pearson India