Chapter 6 – Managing Quality and Time to Create Value

This chapter discusses the methods and measure that a company concerned about the efficiency of their processes and quality of their goods and services use to stay ahead of the competition. The chapter describes ten important cost management tools:

1. Histograms
2. Control charts
3. Run charts
4. Cause-and-effect diagrams
5. Scatter diagrams
6. Flowcharts
7. Pareto charts
8. Cost-of-quality reports
9. Overall equipment effectiveness
10. Financial analysis.

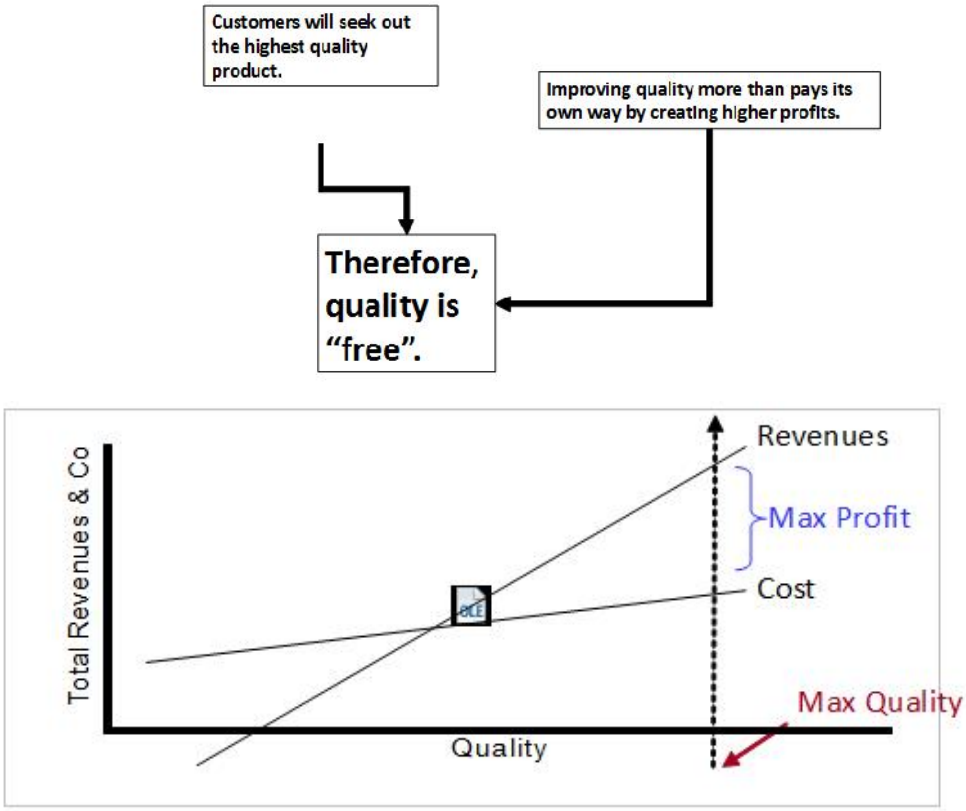
They are useful tools for monitoring process quality, time, efficiency and capacity and for preventing mistakes in meeting customer needs. The chapter also discusses how just-in-time methods combine concerns for managing and evaluating quality, time, efficiency and capacity.

LO 1: Evaluate the similarities and differences of total quality management and return-on-quality approaches to managing quality.

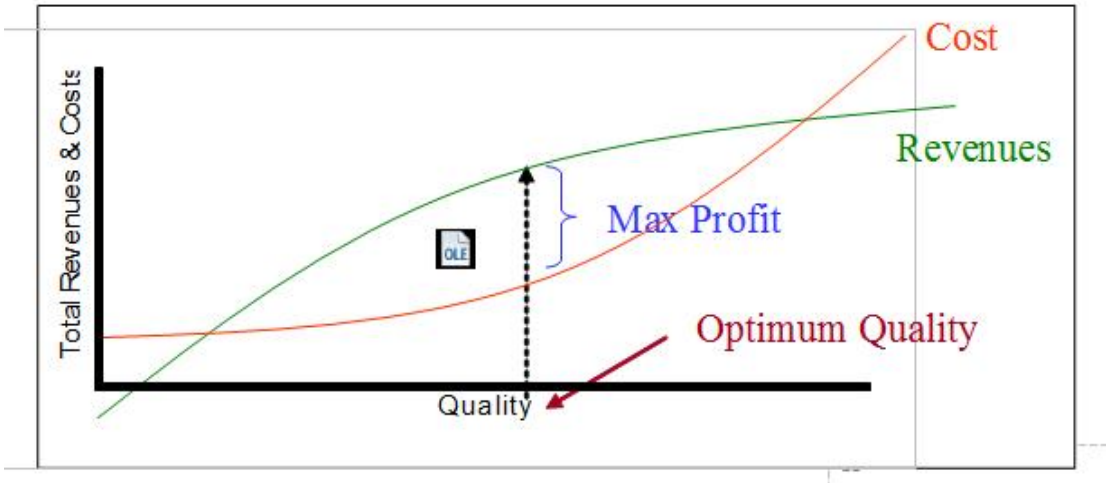
There are now two somewhat competing approaches to improving product and service quality:

1. Total quality management
2. Return on quality, a traditional view of quality that is re-emerging

Total quality management (TQM): Is the view that improvement in quality, as defined by customers, always results in improved organisational performance because improving quality improves efficiency as problems are identified and eliminated. Furthermore the quest for improved quality is never finished.



Return on Quality (ROQ): The view that assumes a trade-off between the costs and benefits of improving quality. Although ROQ advocates believe quality is extremely important, they argue that the highest profits are obtained at an optimum quality level of products and services, which maximises profits rather than quality. The optimum quality level is almost always lower than the maximum quality level, which is the total delight of the customer or zero defects, depending on one's definition of quality. Total delight occurs when a customer receives a product or service that far exceeds his or her expectations of quality.



Defect: An attribute (tangible or intangible) that falls short of customer expectations.

According to the ROQ view, at some point, the cost of improving quality must exceed the benefits of increased revenues. In other words, the ROQ approach argues that there can be too much quality, too few defects and too much customer satisfaction because costs of improved quality could increase at a higher rate than revenues. Even if the ROQ approach is more profitable, however, it might not be the basis of an effective marketing campaign. Furthermore, ROQ might lead to complacency with current levels of quality, whereas TQM is relentless in its search for continuous improvement.

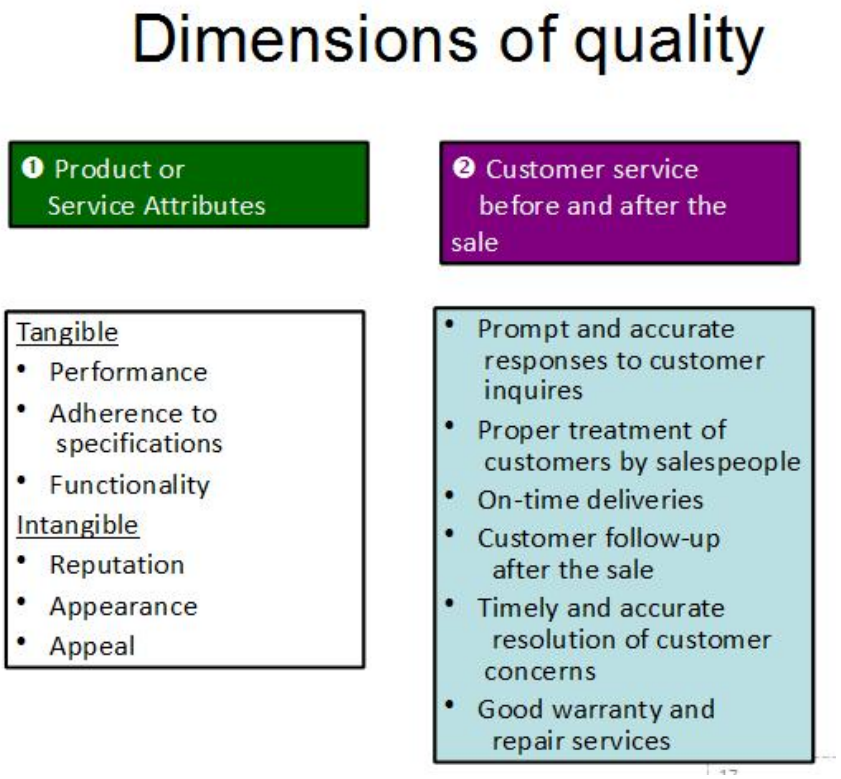
Customer-focused quality: A broad focus on meeting or exceeding customer expectations rather than a focus on only one of the dimensions of quality. A firm can measures its quality on two generally accepted quality dimensions:
1) product or service attributes
2) customer service before and after the sale

A product's attributes refer to its tangible and intangible features. **Tangible features**, in general, include performance, adherence to specifications, and functionality. Tangible features could include the following:

I**ntangible features** of products include reputation, taste, appearance, style and appeal, which could be as important as tangible features to some customers.

Customers' perceptions of service before and after the sale influence whether they will become new customers and remain repeat customers. Customer service features include:

- Provision on pre-sale information.
- Proper treatment of customers by sales people.
- On-time delivery to the customer after the product or service is ordered.



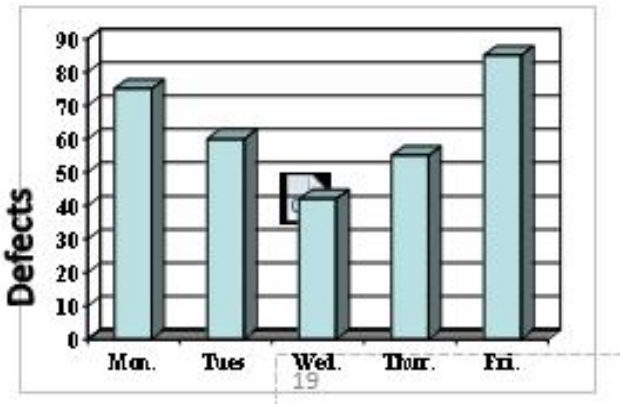
LO 2: Measure and analyse the dimensions of quality with commonly used diagrams, charts and reports.

First, the company needs to identify indicators of customer-defined quality.
Second, the company needs diagnostic information to suggest what the problem is and, perhaps, a way to solve it.

Quality experts believe that variations in product features are a primary source of poor quality. Variability increases the chance for product features to disappoint customers.

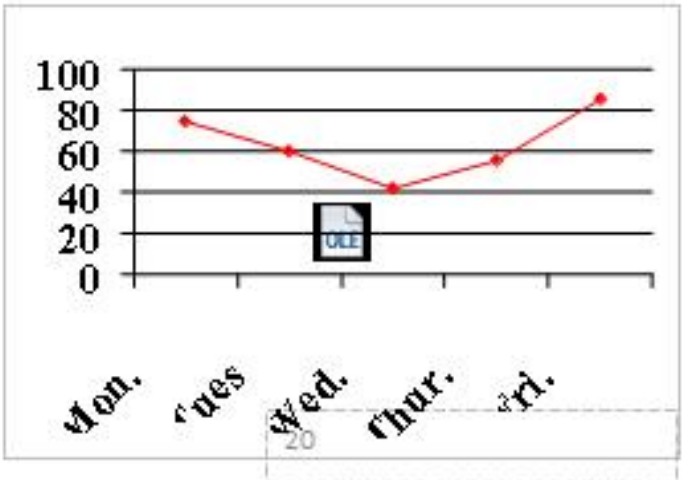
Organisations usually seek to measure the quality of products while in process before exposing them to customers. Leading indicators of quality measure the features that customers value while manufacturing the product and before shipment or while providing a service but before completion. Lagging indicators of quality measure features of products after exposure or use by customers. Lagging indicators can be important, but, because damage could already be done by poor quality, they are not as valuable as leading indicators.

Histograms
A histogram is a chart that displays a frequency distribution of tangible or intangible process outcomes, including the range and degree of concentration, means more variation and increased likelihood that the customer received poor-quality service. Conversely, a narrower range, with tighter concentration, improves the likelihood that customers received good and high-quality service.

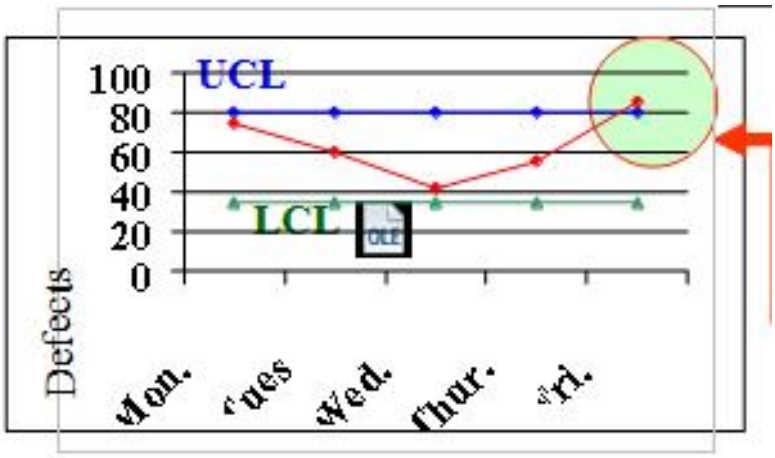


Run chart

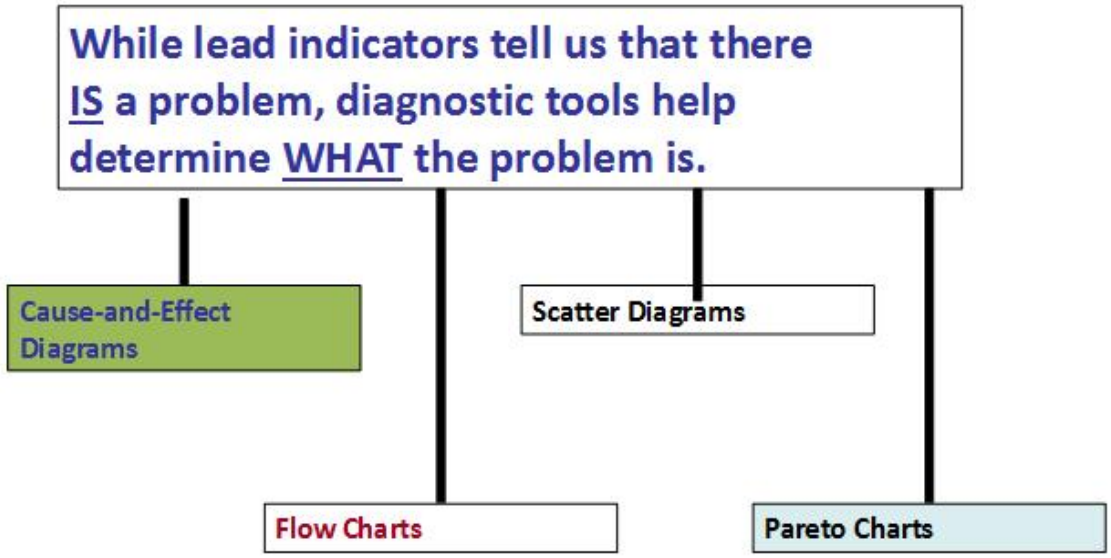
A run chart shows trends in variation in product or service attributes over time by reflecting measures of important quality features taken at defined points in time. Employees use run charts to identify persistent trends in important attributes that are adverse or beneficial to quality.



A **control chart** also describes variation in product or service attributes over time by measuring important quality features. Additionally, it compares attributes to upper and lower control limits, which are the maximum- and minimum-desired levels of product or service features. A low level of variation in product or service features is desirable, but deviations that fall either above the upper control limit or below the lower control limit are unacceptable defects because
a) the product or service will not perform reliably or
b) customers will be disappointed by worse-then-expected intangible features.



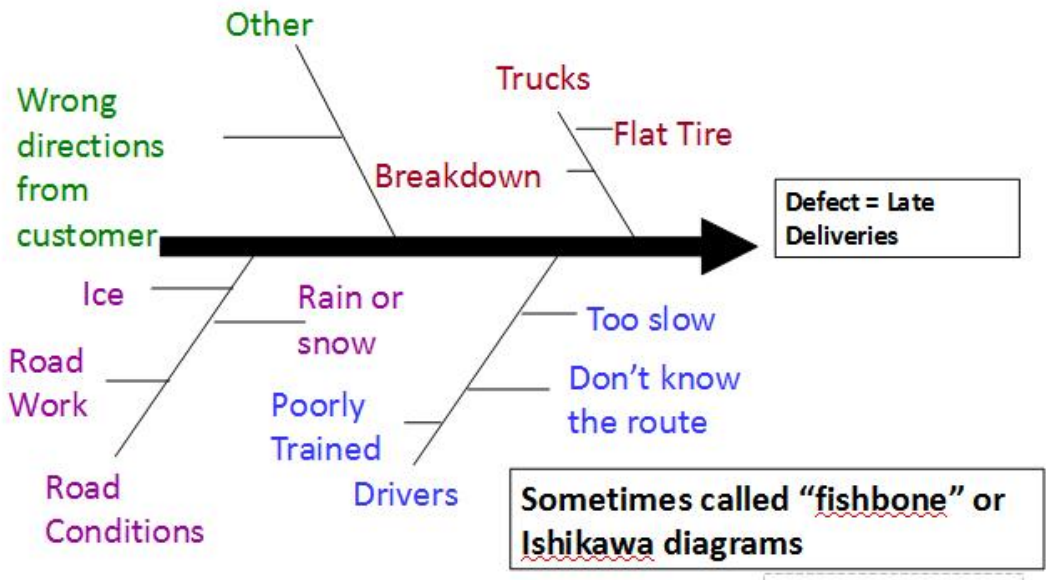
Leading indicator information identifies potential quality problems but usually does not diagnose their causes.



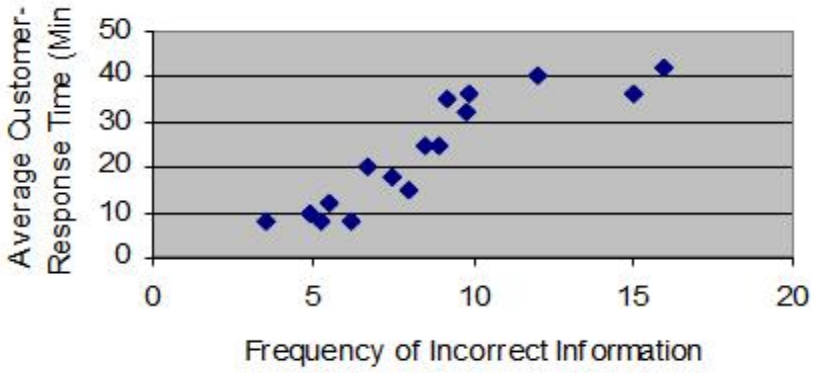
Cause-and-effect diagrams

Cause-and-effect analysis involves formulating diagnostic signals that identify potential causes of product or service defects. It first defines the defect, for example, excessive and variable customer response time, and then the causes that could contribute to the problems. The potential causes of these problems in customer response time can be deficiencies in:

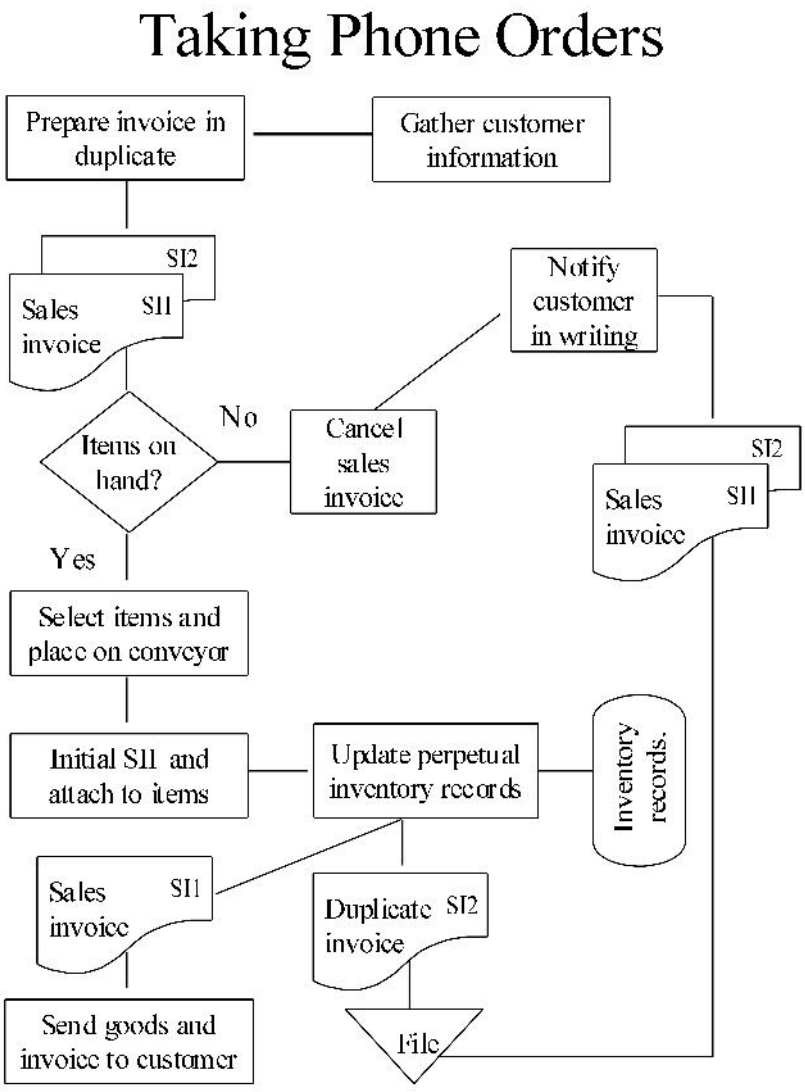
- Human resources
- Physical resources
- Procedures
- Information technology
- Communication



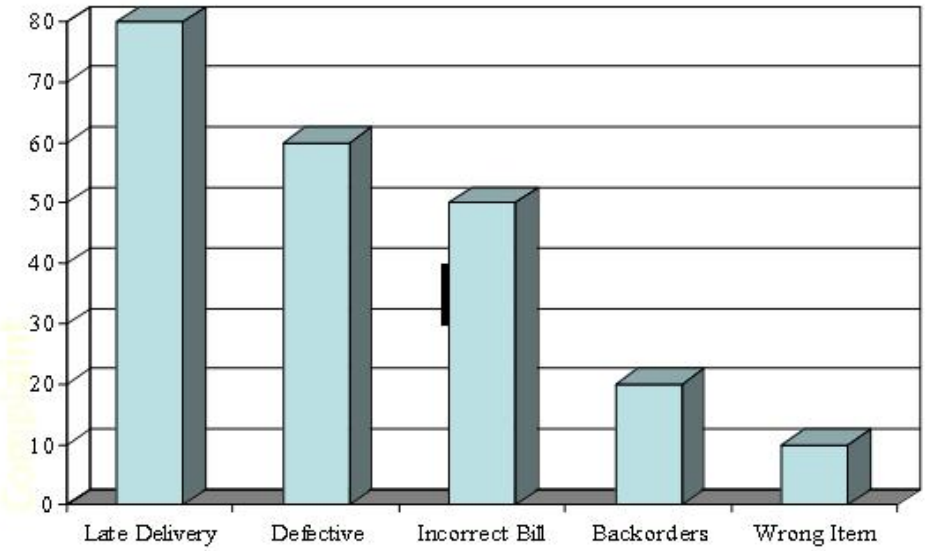
Scatter diagrams
A scatter diagram is a plot of two measures that could be related. Such a plot helps analysts to diagnose the cause and effect between outcomes and the activities that might drive them.



Flowcharts
A flowchart reflects cause-and-effect and sequential linkages among process activities.



Pareto charts
A Pareto chart prioritises the causes of problems or defects as bars of varying height, in order of frequency or size.



Customer satisfaction: is the degree to which customers' expectations of product attributes, service and price have been or will be met. Organisations measure customer satisfaction both as leading indicators of futures sales and diagnostic tools to discover causes of unexpectedly low or high sales. The most common methods of measuring customer satisfaction are phone or online surveys by which companies ask current or potential customers to rate attributes of products or services and customer service on a multiple-point scale. Other common measurement tools are to:
1) ask focus groups of customers to evaluate real or proposed products or services and
2) use phantom, or unknown, shoppers, who really are employed by the agency evaluating the product or service and who report their experiences.

Market forces set competitive prices. Customers evaluate product attributes and customer service (i.e., quality) based on what is available at a comparable price from other sources. Costs of products are leading indicators of an organisation's ability to meet market prices or offer competitive bid prices.

Cost of quality (COQ): The costs of activities to control quality and the costs of activities to correct a failure to control quality. Costs to control quality are associated with leading indicators of imminent quality and customer value, and costs to correct failures could be leading indicators of future decreased sales.
Controlling quality
The two general activities to control quality are prevention activities and appraisal activities.

Prevention: activities that seek to prevent defects in the products offered to customers. Examples:

- Supplier certification
- Product design for manufacturability
- Quality training
- Quality evaluations
- Process improvements

TQM advocates argue that the most efficient use of quality resources is on prevention activities. Preventing poor quality, they argue, is the only value-added quality activity and the most profitable way to control quality.
ROQ advocates agree that preventing defects is effective but also argue that preventing ALL defects

would be prohibitively expensive. Some non-value-added quality activities in conjunction with activities that prevent defects could yield the most profitable level of quality.

Appraisal (also called detection or inspection activities): inspect inputs and attributes of individual units of product or service to detect whether they conform to specifications or customer expectations: Examples:

- Inspecting materials
- Inspecting machines
- Inspecting processes
- Performing automated inspection
- Employing statistical process control
- Sampling at end of process.
- Testing at end of process
- Field testing

Appraisal activities usually are recognised as non-value-added because customers do not pay for inspection – they pay for a high-quality product.

Failing to control quality

Failing to control quality causes internal failure and external failure activities. Organisations universally regard these as non-value-added activities.

Internal failure: activities that are required to correct defective processes, products and services that are detected before delivering them to customers. Examples:

- Disposing of scrap
- Performing rework
- Re-inspecting/Retesting
- Delaying processes

External failure: activities that are required to correct defective products or services after they have been delivered to customers. They include:

- Warranty repairs
- Field replacement
- Product liability settlements
- Customer-complaint
- Restoration of reputation
- Lost sales

Although the out-of-pocket costs of these activities can be large, they can be small compared to the opportunity costs of future sales. Because external failure costs have such harmful potential, TQM advocates argue that nearly every activity to prevent an external failure is cost effective.

Measuring costs of quality

Organisations that use ABC and ABM have the activity-based information necessary to compile cost-of-quality information. The only additional step beyond ABM is classifying activities according to the cost-of-quality category, as described earlier. Simply sorting the activity-cost data by cost-of-quality classification yields the cost of the quality measures.

Customers would not willingly pay for the performance of appraisal, internal failure and external failure activities.

Some firms believe that COQ information is not sufficient by itself to manage quality since it does not measure the quality of services delivered to customers or their satisfaction with services

received.

European Quality Award (EQA): examines the impact of quality on a company, its customers and the company's social and environmental community.
Malcolm Baldrige National Quality Award: Recognises US firms with outstanding records of quality improvement and quality management.
Deming Prize: Awarded to companies around the world that excel in quality improvement.
ISO 9000: A family of international standards for quality management. Global guidelines for design, development, production, final inspection and testing, installation, and servicing of products, processes and services.

LO 3: Understand and explain the importance of managing process time.

Some argue that quality and time are inextricably linked, because one cannot truly decrease processing time without increasing quality. Simply decreasing processing time is likely to increase defective products that increase failure costs.

New product development time: The period between the first consideration of a product and its initial sale to the customer.

Customer response time: The amount of time between a customer's placing an order for a product or requesting service and delivering the product or service to the customer.

Bottleneck resources: The constraining factors limiting production or sales, and by keeping some reserve capacity for unexpected but valuable orders.

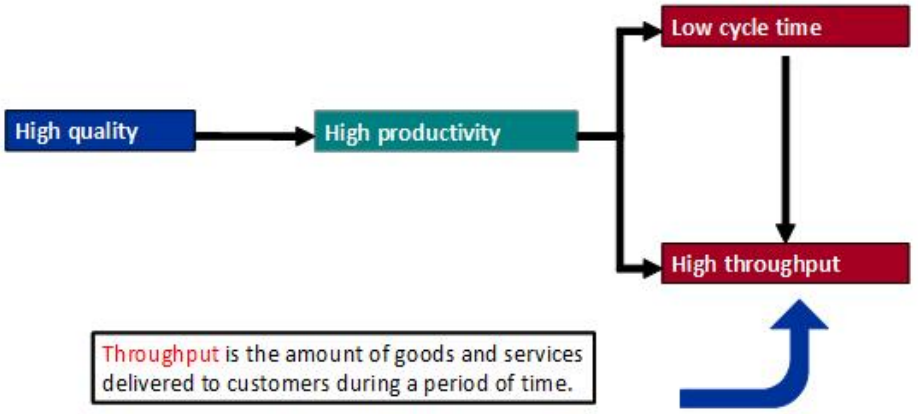
Production cycle time (cycle time): The elapsed time between starting and finishing a product process, including any time to correct mistakes. Most dramatic improvements in customer response time could be made possible b eliminating non-value-added and poor-quality-related activities in production cycle time.

Time-driven ABC: A method of ABC that uses time as the cost driver to replace some or all of the multiple cost drivers in an ABC system. One can compute the time-driven cost-driver rate as equal to: Total cost supplied to perform activity during a time/Total time used to perform activity during a period.

LO 4: Measure and manage efficiency and capacity.

Process efficiency: The ability to transform inputs into throughput at the lowest cost.

Throughput: The amount of goods and services produced and delivered to customers during a period of time measured in dollar terms or physical measures.



Organisations manage two types of processes: production and business.

Production processes: directly result in the production of products or services provided to external customers.

Business processes: support or enable production processes.

Common measures of efficiency of both production and business processes include, in addition to quality:

- Productivity, a ratio of outcomes of a process divided by the amount of resources necessary to complete the process
- Average cycle time, the total processing time for all units divided by good units produced
- Throughput time ratio, the ratio of time spent adding value to total cycle time.

Total factor productivity is the value of goods and services (measured as sales revenue) divided by the total cost to provide them. This diagnostic tool is especially useful when benchmarked against that of competitors.

Throughput efficiency: The relation of throughput achieved to resources used. The throughput time ratio measures throughput efficiency as follows:

Throughput time ratio = Value-added time/ Total processing time

Process capacity: A measure of a process's ability to transform resources into valued products and services, usually expressed as a rate of processing inputs or generating outputs per time period.
A process- or system-wide perspective is necessary to manage capacity.

Measuring capacity
Five common measures – theoretical, practical, normal, buffer and excess capacity – influence how organisations manage process capacity.

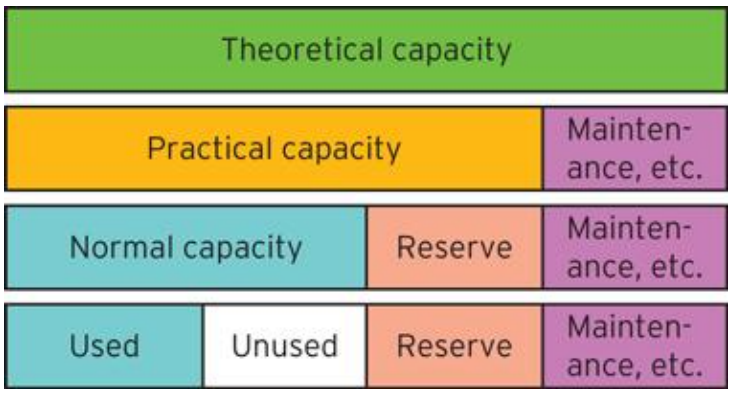
Theoretical capacity: The maximum possible rate of transformation of inputs into outputs if the process were fully used, with no downtime or unused capacity. Most organisations operate processes at less than theoretical capacity for a number of reasons, including the following:

- Planned downtime usually is necessary for scheduled maintenance or improvements to equipment and procedures.
- Unplanned downtime caused by breakdown or delays in supply of inputs.
- Some capacity can be reserved for unforeseen needs and the ability to be flexible.
- Demand for the output of the process might be less than the theoretical capacity.

The practical capacity of a process is its theoretical capacity less planned downtime for scheduled maintenance or improvements. Practical capacity arguably should reflect expected demand for the output of the process. Normal capacity is an average level of usage that often is less than practical capacity.

Buffer capacity: An amount of capacity that may be intentionally reserved for unexpected demand.

Excess (or unused) capacity: The amount by which practical capacity exceeds the demand plus buffer capacity. Persistent unused capacity indicates wasted resources; negative unused capacity can indicate lost opportunities.



Note that organisations sometimes allow processes to operate in excess of practical capacity to meet urgent needs. In the long run, however, skipping maintenance and planned improvements will lead to breakdown and reduced capacity.

LO 5: Evaluate how just-in-time methods create benefits by combining management of quality, time productivity and capacity.

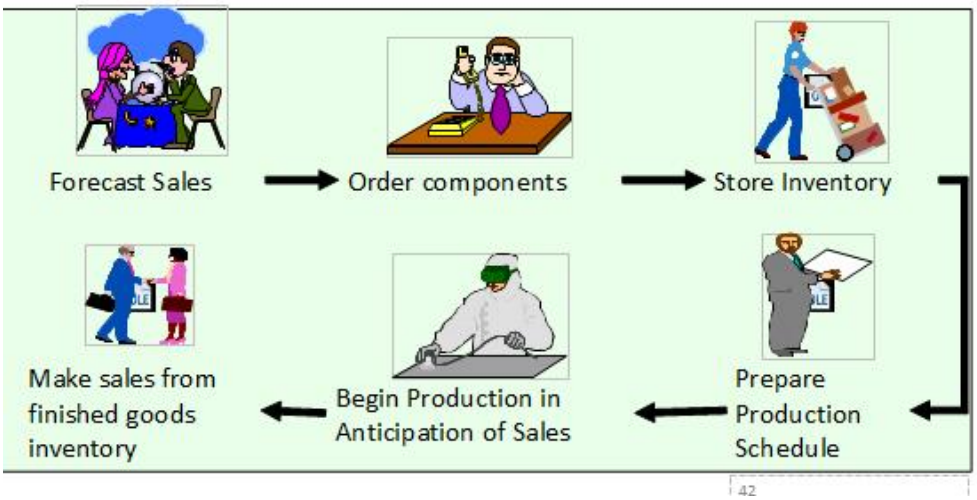
Just-in-time or lean processes: Purchase, make and deliver services and products when needed. Organisations that use JIT find that it reduces, or potentially eliminates, inventory carrying costs.

Inventory carrying costs: Costs of obsolescence, receiving, handling, storing and insuring inventory.

Traditional 'push' manufacturing
A traditional manufacturer begins the manufacturing cycle by forecasting total orders for a time period. For example, a traditional manufacturer of personal computers does the following:

- Forecast sales
- Orders all components
- Prepares a production schedule

- Upon receiving a customer order, ships products

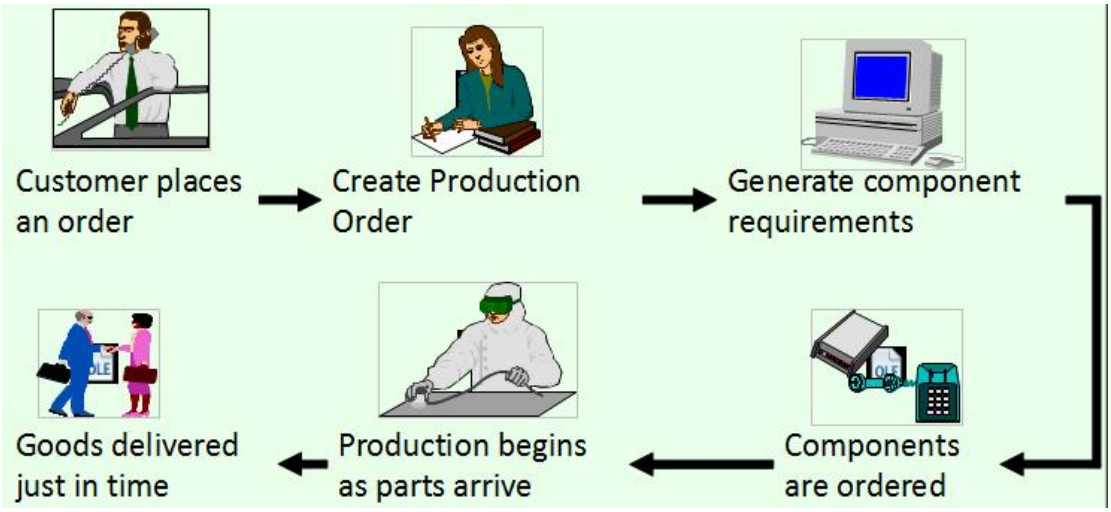


Why is this approach to manufacturing possible inefficient?
First, sales forecasting drives it, and sales forecasting can be an inaccurate guide to production scheduling.
Second, the traditional manufacturer usually does not balance the timing of receiving materials and of all production activities with capacity. Not considering capacity can result in a temporary, wasteful build-up of inventories if this is merely a matter of timing, or a permanent build-up of inventories if managers are covering their quality problem by ordering too many material or over-producing.

JIT 'pull' manufacturing
Although a JIT/lean manufacturer also uses long-term sales forecasting to determine its scale of operations and capacity, JIT production is 'pulled' through the process by customer orders rather than pushed by a master production schedule. A JIT manufacturer pulls an order through its production process in a sequence almost the reverse of that of the traditional manufacturer:

- A customer places an order
- The sales order triggers a production order
- The production order triggers the ordering and assembly of individual components
- The requirement for components trigger orders to suppliers
- The customer receives the ordered goods

The JIT approach is flexible to customer needs



Overall equipment effectiveness (OEE) is a summary measure of the use of process capacity to create good (defect-free) output.

Availability = Operating time/Planned operating time
Performance = Ideal cycle time/Actual cycle time
Quality = Good units/Total units

OEE = Availability x Performance x Quality = Actual good products completed/Maximum

JIT/Lean Success Factors

- Commitment to quality
- Creation of flexible capacity or predictable orders
- Achievement of reliable supplier relationship
- Development of smooth production flow
- Maintenance of well-trained, motivated, flexible workforce
- Achievement and improvement of short cycle and customer-response times

LO 6: Understand how companies manage long-term projects and their costs.

The manager of a long-term project must first establish a budget of costs to be incurred throughout the project at various stages of completion. Then, as the project progresses, the manager evaluates two critical areas:
1) the planned cost of work completed to date versus the actual cost of work completed to date and
2) the planned percentage or stage of completion since the project began versus the actual percentage or stage of completion.

Gantt charts: Depict the stages required to complete a project and the sequence in which the stage are to be performed.

LO 6 Appendix 6: Understand how to construct and use control charts.

Control charts display measures of important product or service attributes for individual items or for a sample of items to disclose attribute measures and variation in the production process. In most cases, control charts provide multiple benefits such as

1) causing employees to directly monitor the quality or their work
2) detecting defects quickly and at the source and
3) providing a common, objective means of communicating the quality of a process or product.

Statistical control chart: Displays attributes, for example, customer response times, against the historical parameters of the mean and variation. Variation usually is displayed as an interval based on the historical range of outcomes or 2 or 3 standard deviations above and below the mean.

Whether to use the tighter target limits rather than the looser statistical limits depends on the organisation's estimates of the relative costs of:

- Intervening when a violation is detected (correctly or incorrectly) using tight limits. These costs include finding and correcting causes of defects, rework, delays and even lost sales.
- Not intervening when a violation (from the customer's perspective) occurs but is not detected using lose limits. These costs include internal and external failures, which could be large.

Patterns of variation

Run: refers to sequential values above or below the mean or values sequentially increasing or decreasing. Based on an approximately 1 per cent statistical probability of a run occurring by chance, a statistically out-of-control process can be identified using the following rules of thumb:

- Seven successive values on the same side of the mean or target
- Four or more successive values outside 1 standard deviation from the mean or target
- Two or more successive values outside 2 standard deviations from the mean or target

Causes of runs include the following:

- Worker fatigue
- Wear and deterioration of tools and equipment
- Changes in environmental conditions
- Accumulation of waste, scrap and excess parts that cause congestion
- Learning and improved use of resources

The following can cause cyclical behaviour:

- Recurring conditions (night/day, hot/cold)
- Rotation of employees, equipment or suppliers
- Rotation of testing and inspection
- Periodic maintenance or training

Causes of extreme jumps include:

- Changes in tools, equipment or set-ups
- Change of employees
- Changes or errors in testing or reporting procedures

The following can cause values concentrated near control limits

- Major differences in the quality of resources (human and physical)
- Mistakenly plotting outcomes from different processes on the same chart