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BBA | SEM 5 | OPERATIONS MANAGEMENT | CALICUT UNIVERSITY

Module II: Tools and Techniques for Global Operations Management

6. Statistical Process Control for Quality Management: Control Charts

Statistical Process Control (SPC)

Statistical Process Control (SPC) is a quality management technique that uses statistical methods to monitor, control, and improve production processes.

The main objective of SPC is to identify variations in a process before they result in defective products.

Instead of inspecting quality only after production, SPC continuously monitors the process during production.

Objectives of SPC

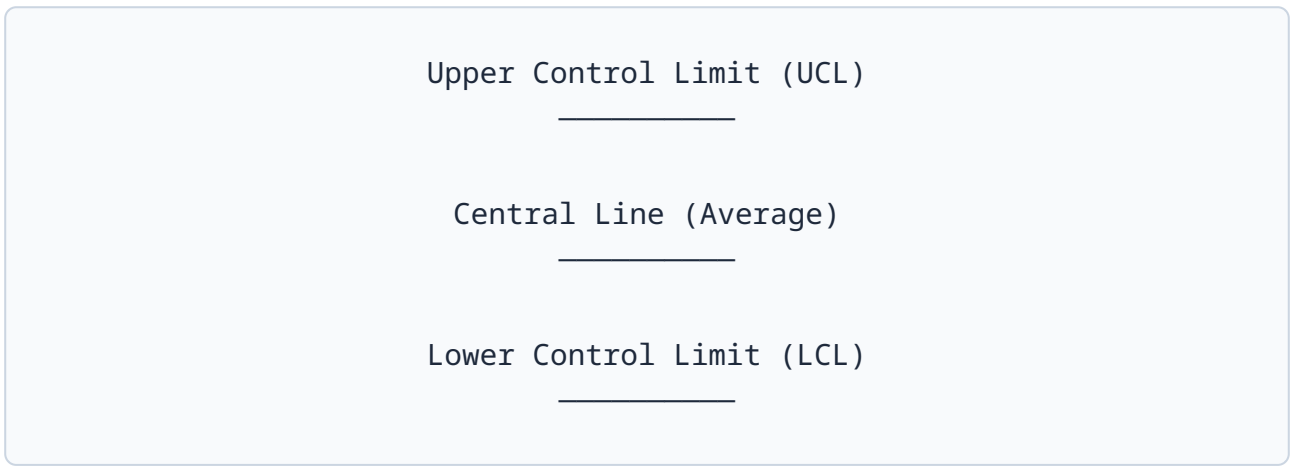
- Maintain consistent quality
- Detect process variations
- Reduce defects and waste
- Improve productivity
- Support continuous improvement

> **Example:** A bottling company regularly checks the amount of liquid filled in bottles to ensure consistency.

Control Charts

A control chart is a graphical tool used to monitor process performance over time. It helps determine whether a process is operating within acceptable limits or whether corrective action is required.

Components of a Control Chart



Interpretation

- Points within control limits indicate the process is under control.
- Points outside control limits indicate possible problems requiring investigation.

Benefits of Control Charts

- Early detection of quality problems
- Reduction of defects
- Improved process stability
- Better decision-making

> **Example:** A factory producing screws may use control charts to monitor screw length and detect unusual variations.

7. Process and Capacity Design in Global Operations: Bottlenecks, Capacity Constraints and Operational Hedging Strategies

Process Design in Global Operations

Process design refers to planning how goods and services will be produced.

It determines the sequence of activities, technologies, resources, and workflows needed to create value.

A well-designed process improves efficiency, quality, and customer satisfaction.

Objectives of Process Design

- Improve productivity
- Reduce waste
- Ensure quality

- Lower operational costs
- Increase customer satisfaction

> **Example:** An automobile assembly line is carefully designed to ensure smooth production flow.

Capacity Design in Global Operations

Capacity design involves determining the maximum output that a system can produce within a given period. Organizations must balance capacity with customer demand.

Importance of Capacity Design

- Avoids underutilization
- Prevents overloading
- Improves efficiency
- Supports customer service

> **Example:** A manufacturing plant planning how many units it can produce daily.

Bottlenecks

A bottleneck is a stage in the process where the flow of work is restricted due to limited capacity.

Bottlenecks slow down the entire production system.

Causes of Bottlenecks

- Equipment limitations
- Labor shortages
- Poor process design
- Excessive demand

Effects of Bottlenecks

- Delayed production
- Increased waiting time
- Reduced productivity
- Higher operational costs

> **Example:** If packaging takes longer than manufacturing, packaging becomes the bottleneck.

Capacity Constraints

Capacity constraints are limitations that prevent an organization from meeting desired output levels.

Common Capacity Constraints

- Limited machinery
- Insufficient workforce
- Raw material shortages
- Financial limitations
- Storage limitations

> **Example:** A factory receiving more orders than its machines can handle.

Operational Hedging Strategies

Operational hedging refers to strategies used to reduce risks arising from uncertainties in global operations.

Companies spread operations across different locations to reduce the impact of disruptions.

Benefits of Operational Hedging

- Reduces supply chain risk
- Improves flexibility
- Enhances business continuity
- Reduces dependence on one location

> **Example:** A multinational company manufacturing products in multiple countries instead of relying on a single factory.

8. Forecasting Techniques for Global Operations: Qualitative and Quantitative, Error in Forecasting Methods

Forecasting

Forecasting is the process of predicting future events, demand, sales, or operational requirements based on available information.

Accurate forecasting helps organizations plan production, inventory, staffing, and investments.

Importance of Forecasting

- Reduces uncertainty

- Improves planning
- Supports decision-making
- Optimizes resource allocation

> **Example:** Retailers forecasting demand during festival seasons.

Qualitative Forecasting

Qualitative forecasting relies on expert opinions, experience, judgment, and market insights. It is useful when historical data is limited.

Methods of Qualitative Forecasting

- **Expert Opinion:** Forecasts based on specialist knowledge.
- **Delphi Method:** Experts provide forecasts independently until consensus is reached.
- **Market Research:** Customer surveys and market studies are conducted.

> **Example:** Predicting demand for a completely new product.

Quantitative Forecasting

Quantitative forecasting uses historical data and mathematical techniques. It is suitable when reliable data is available.

Methods of Quantitative Forecasting

- **Time Series Analysis:** Uses past trends to predict future values.
- **Moving Average:** Calculates averages over specific periods.
- **Regression Analysis:** Examines relationships between variables.

> **Example:** Using previous years' sales data to estimate future demand.

Difference Between Qualitative and Quantitative Forecasting

Qualitative Forecasting	Quantitative Forecasting
Based on judgment	Based on data
Useful for new products	Useful when historical data exists
Subjective	Objective
Less mathematical	More mathematical

Error in Forecasting Methods

Forecasts are rarely perfect and may contain errors.

Causes of Forecasting Errors

- **Inaccurate Data:** Poor-quality data produces unreliable forecasts.
- **Sudden Market Changes:** Unexpected events may change demand patterns.
- **Incorrect Assumptions:** Faulty assumptions lead to inaccurate predictions.
- **Human Bias:** Personal judgment may influence forecasts.

Consequences of Forecasting Errors

- Excess inventory
- Stock shortages
- Higher costs
- Customer dissatisfaction

> **Example:** A company overestimating demand and producing more products than it can sell.

9. Global Inventory Management and Control: ABC and EOQ

Global Inventory Management and Control

Inventory management involves planning, storing, controlling, and monitoring inventory to ensure the right products are available at the right time.

Global inventory management becomes more complex due to international suppliers, transportation delays, and varying market demand.

Objectives of Inventory Management

- Avoid stockouts
- Minimize holding costs
- Ensure smooth operations
- Improve customer service

> **Example:** A multinational retailer managing inventory across multiple countries.

ABC Analysis

ABC Analysis is a technique used to classify inventory based on importance and value.

- **Category A:** High-value items with low quantity. These items require strict control.
- **Category B:** Moderate-value items requiring normal control.
- **Category C:** Low-value items with high quantity. These require less control.

ABC Classification

Category	Characteristics
A	High value, low quantity
B	Medium value, medium quantity
C	Low value, high quantity

> **Example:** A smartphone manufacturer may classify processors as A-items and packaging materials as C-items.

EOQ (Economic Order Quantity)

EOQ is a technique used to determine the optimal order quantity that minimizes total inventory costs.

The goal is to balance: **Ordering costs** and **Inventory carrying costs**.

Benefits of EOQ

- Reduces inventory costs
- Avoids overstocking
- Improves inventory planning
- Optimizes purchasing decisions

> **Example:** A company calculates the ideal quantity of raw materials to order each time to minimize overall costs.

Importance of ABC and EOQ

Together, ABC analysis and EOQ help organizations:

- Control inventory efficiently
- Reduce costs
- Improve inventory turnover
- Enhance operational performance

10. Just-in-Time and Lean Systems Strategies for Global Operations

Just-in-Time (JIT)

Just-in-Time is an inventory management philosophy where materials and products arrive exactly when needed for production.

The objective is to minimize inventory levels and eliminate waste.

Principles of JIT

- Produce only what is needed
- Reduce inventory
- Improve efficiency
- Eliminate waste
- Enhance quality

Advantages of JIT

- Lower inventory costs
- Reduced storage requirements
- Faster production flow
- Improved quality

Limitations of JIT

- Highly dependent on suppliers
- Vulnerable to supply chain disruptions
- Requires accurate demand forecasting

> **Example:** An automobile manufacturer receiving components shortly before assembly.

Lean Systems

Lean systems focus on maximizing customer value while minimizing waste.

Lean management seeks to improve efficiency throughout the entire operation.

Types of Waste Identified in Lean Systems

Overproduction

Producing more than required.

Waiting

Idle time between activities.

Transportation

Unnecessary movement of materials.

Excess Inventory

Holding more inventory than necessary.

Defects

Producing faulty products.

Unnecessary Motion

Inefficient movement by workers.

Overprocessing

Performing unnecessary activities.

Underutilized Talent

Failure to use employee skills effectively.

Lean Principles

- **Identify Customer Value:** Understand what customers truly value.
- **Map the Value Stream:** Identify activities that create value.
- **Create Continuous Flow:** Ensure smooth movement of work.
- **Establish Pull System:** Produce according to customer demand.
- **Pursue Perfection:** Continuously improve processes.

Difference Between JIT and Lean Systems

Just-in-Time (JIT)	Lean Systems
Focuses mainly on inventory reduction	Focuses on eliminating all forms of waste
Ensures materials arrive when needed	Improves the entire process
Inventory management approach	Overall management philosophy
Narrower scope	Broader scope

> **Example:** Toyota successfully uses both JIT and Lean principles to achieve high efficiency, low costs, and superior product quality.