# Operations Management

# Contents

**Basic Concepts:** Introduction, Operations Management Basics

**Product and Process Design:** The Product Development Process, Analyzing a Process, Process Decision

**Facility Location Planning & Facility Layout:** Facility Planning, Location Decisions, Facility Layout

**Capacity Design and Planning:** Introduction - Capacity Planning, Managing Supply and Demand

**Production Planning:** Introduction, Scheduling

**Productivity and Work Study:** The Organization and Productivity, Job Design

**Materials, Purchasing & Stores Management:** Materials Management, The Supply Chain,Supply Chain Performance

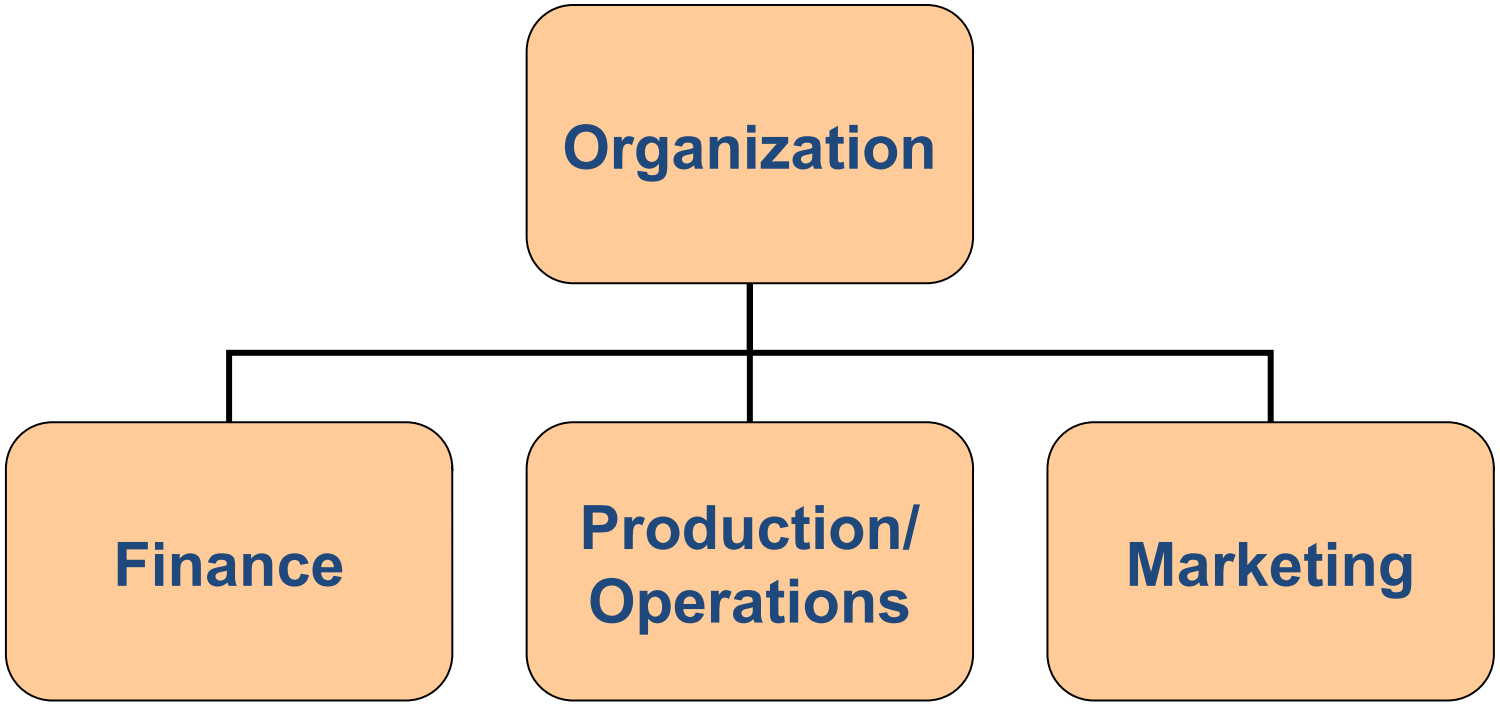
**Inventory Management:** Introduction - Inventory Management, Elementary Inventory Models,Inventory Control

**Managing for Quality:** Introduction, Statistical Control

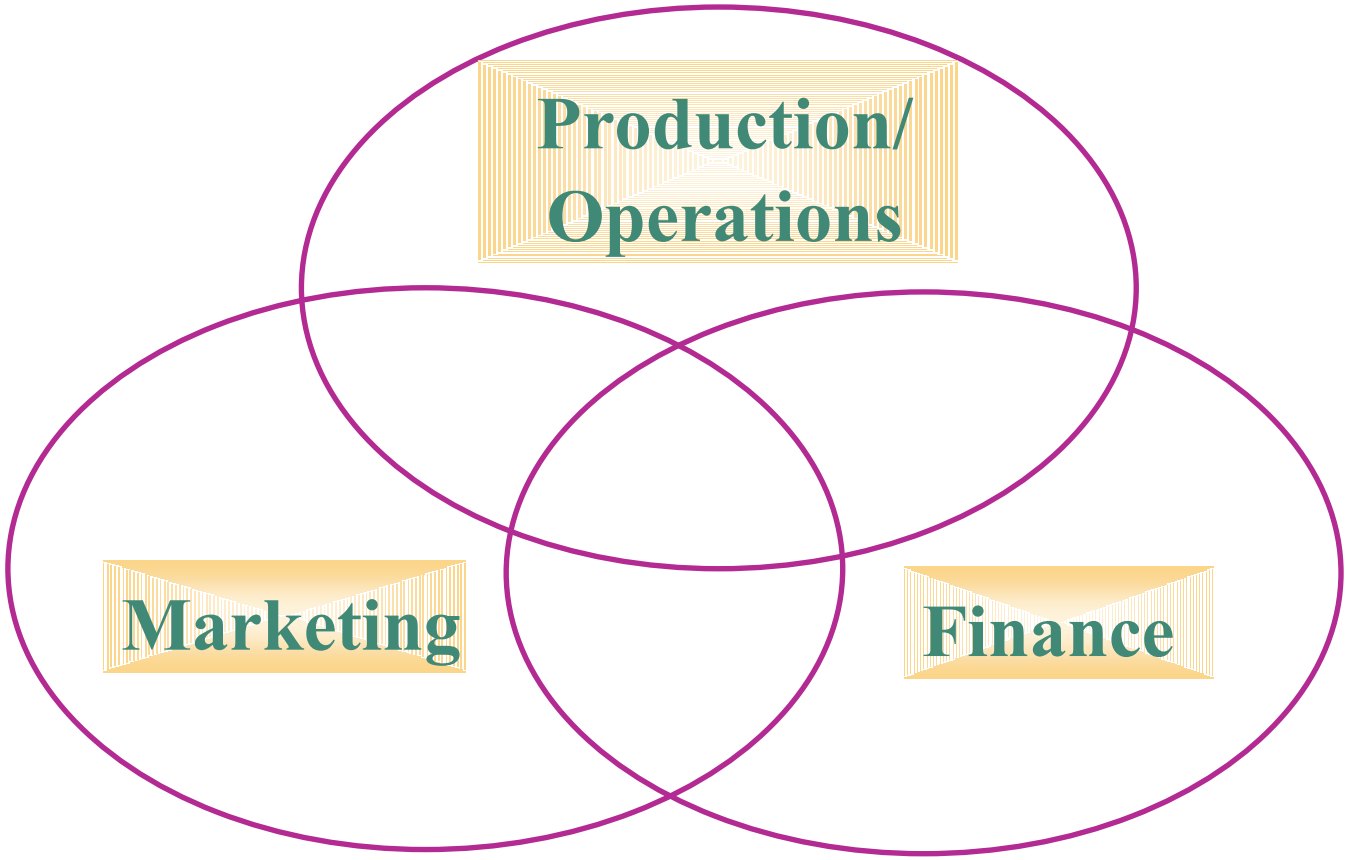
**Maintenance Management:** Introduction-The Maintenance Function, Maintenance Strategies, Maintenance Performance

# Operations Management

- **Operations function consists of all activities *directly* related to producing goods or providing services.**



# Business Operations Overlap



# Examples of operations:

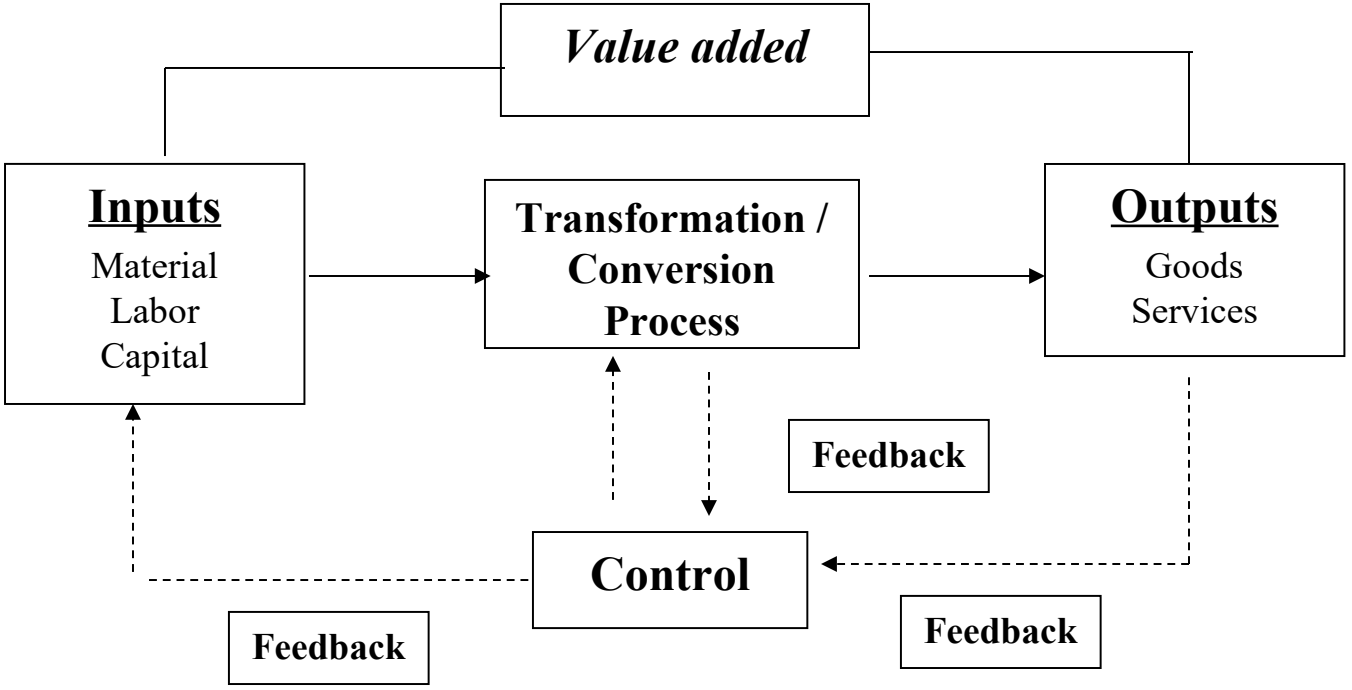
| Operations | Examples |
| --- | --- |
| Goods Production | Farming, Mining, Construction, Manufacturing, Power Generation |
| Storage / Transportation | Warehousing, Trucking, Mail Service, Moving, Taxis, Buses, Hotels, Airlines |
| Exchange | Retailing, Wholesaling, Banking, Renting, Leasing, Library, Loans |
| Entertainment | Films, Radio, Television, Concerts, Recordings |
| Communication | Newspapers, Radio and Television, Newscasts, Telephone, Satellites |

# Definitions

- Operations management is the management of an organization's productive resources or its production system.
- A production system takes inputs and converts them into outputs.
- The conversion process is the predominant activity of a production system.
- The primary concern of an operations manager is the activities of the conversion process.

# Value added

**The difference between the cost of inputs and the value or price of outputs.**



# What is Operations Management? *Defined*

**Operations management (OM) is defined as the design, operation, and improvement of the systems that create and deliver the firm's primary products and services**

# The Importance of Operations Management

- Synergies must exist with other functional areas of the organization

- Operations account for 60-80% of the direct expenses that burden a firm's profit.

# The historical development of operations management

- Operations in some form has been around as long as human endeavor itself but, in manufacturing at least, it has changed dramatically over time

# Three Major Phases

**Craft manufacturing**

- Craft manufacturing describes the process by which skilled craftspeople produce goods in low volume, with a high degree of variety, to meet the requirements of their individual customers.

# Mass production

- In many industries, craft manufacturing began to be replaced by mass production in the 19th century. Mass production involves producing goods in high volume with low variety – the opposite of craft manufacturing.

# Mass Production(Innovations 1)

- **Standardization:**
- An important innovation in operations that made mass production possible was the system of standardised and interchangeable parts known as the ‘American system of manufacture’, which developed in the United States and spread to the United Kingdom and other countries.

# Mass production(Innovations 2)

**Scientific Management**:

- A second innovation was the development by Frederick Taylor (1911) of the system of 'scientific management', which sought to redesign jobs using similar principles to those used in designing machines.

# Mass Production(Innovations 3)

**Moving Assembly Line:**

- A third innovation was the development of the moving assembly line by Henry Ford. Instead of workers bringing all the parts and tools to a fixed location where one car was put together at a time, the assembly line brought the cars to the workers.

# Mass Production (in nut shell)

- A system through which large volumes of standardized products could be assembled by unskilled workers at constantly decreasing costs .

# Modern Period

- During the 1970s, markets became highly fragmented, product life cycles reduced dramatically and consumers had far greater choice than ever before.
- TQM
- JIT
- SCM

# Modern Period(Different Approaches)

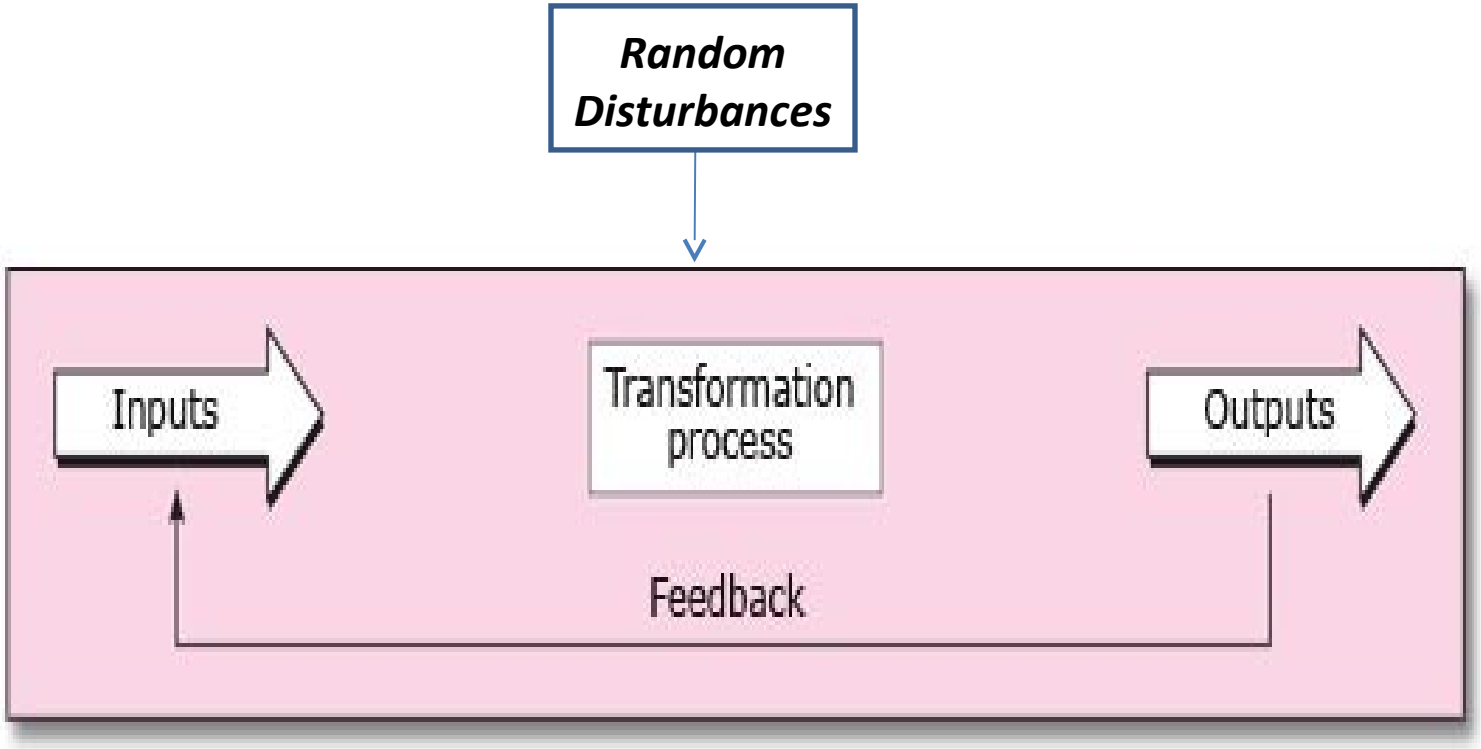
- *Flexible specialization*
- *Lean production*
- *Mass customization*
- *Agile manufacturing*

# Modern Period(in a nutshell)

- These approaches all seek to combine the high volume and low cost associated with mass production with the craft production.

# Transformation Process

# The transformation model



# Input

**Some inputs are used up in the process of creating goods or services; others play a part in the creation process but are not used up. To distinguish between these, input resources are usually classified as:**

- **Transformed Resources**
- **Transforming Resources**

# Input

**Three types of resource that may be transformed in operations are:**

- **Materials**
- **Information**
- **customers**

# Input

**The two types of transforming resource are:**

- **staff**
- **facilities**

# Output

- **The principal outputs of a doctor's surgery are cured patients; the outputs of a nuclear reprocessing plant include reprocessed fuel and nuclear waste. Many transformation processes produce both goods and services. For example, a restaurant provides a service, but also produces goods such as food and drinks.**
- **Transformation processes may result in some undesirable outputs (such as nuclear waste)**

# Activity

| Organisation Outputs | Inputs |
| --- | --- |
| Restaurant | |
| MBA Institute | |
| Refrigerator Mfc. | |

# *Transformation Process*

***A transformation process is defined as a user of resources to transform inputs into some desired outputs***

## Transformations

- **Physical--manufacturing**
- **Locational--transportation**
- **Exchange--retailing**
- **Storage--warehousing**
- **Physiological--health care**
- **Informational--telecommunications**

# Transformation Process

**One useful way of categorising different types of transformation is into:**

- **manufacture**
- **transport**
- **supply**
- **service**

# Feedback

**Feedback information is used to control the operations system, by adjusting the inputs and transformation processes that are used to achieve desired outputs.**

# Random Disturbances

- **It is unplanned or uncontrollable environmental influences.**
- **It causes planned and actual output to differ.**

**Examples:-**

**Weather**

**Inflation**

**Equipment breakdown**

**Government controls**

# Activity

| Organisation | Inputs | Outputs | Random Disturbances |
| --- | --- | --- | --- |
| Feedback | | | |
| Restaurant | | | |
| MBA Institute | | | |
| Refrigerator Mfc. | | | |

# Boundary Of Operations

- **suppliers**
- **customers**
- **the environment.**

# Product & Services

# Product

- **People buy ,want satisfaction, not objects.**
- **Example: Consumers buy televisions because they want entertainment, not because they want a box with a screen.**
- **Product Bundle of physical, service, and symbolic attributes designed to satisfy a customer's wants and needs**

# Goods & Services

- **Services** **Intangible tasks that satisfy the needs of consumer and business users.**
- **Goods** **Tangible products that customers can see, hear, smell, taste, or touch.**

# Products & Services

- **Purely Manufacturing organizations do not just sell a product but provides services also.**
- **Pure service industries such as banks , hospitals , education and consultancies also often provides a product.**

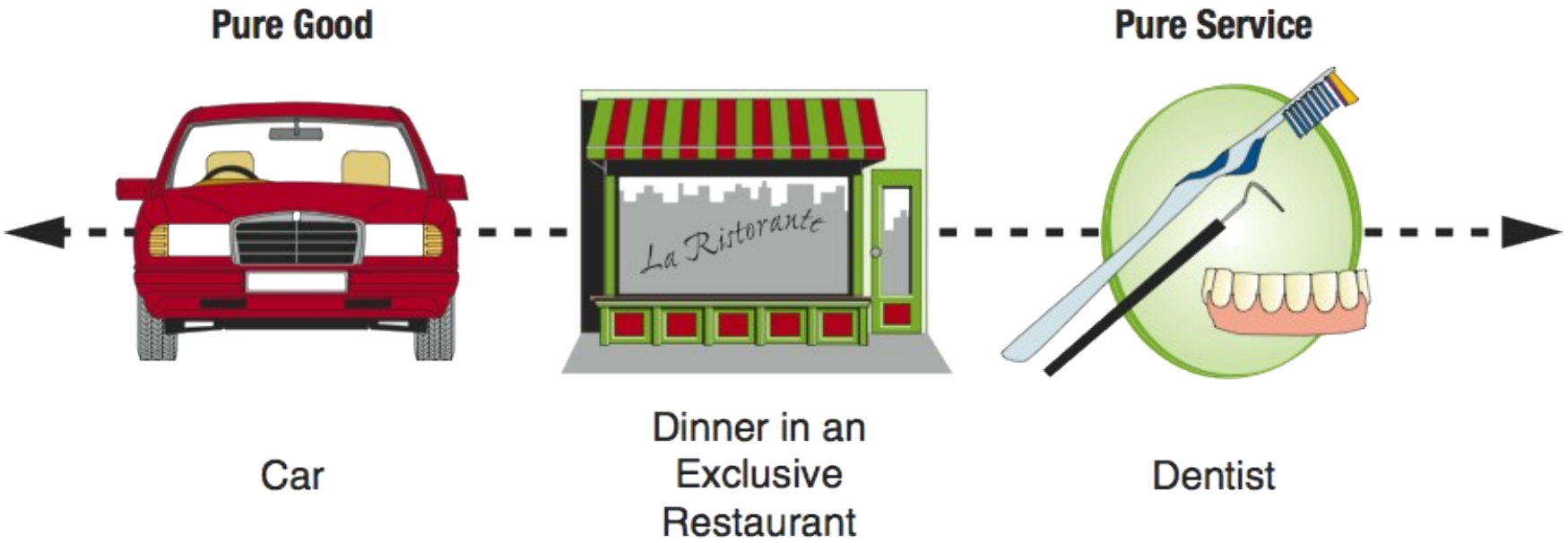
# Product & Services

- **In manufacturing we get a tangible or identifiable product, which is obtained as a series of transformation process.**
- **In service industry end product is often intangible. Here it is the customer that has been processed.**
- **In services it is often the process that are bought rather than the product.**
- **Some organizations may be considered as hybrid.**

  **Example :Restaurant**

  **Flying in an aeroplane.**

## The Goods–Services Continuum



# Role of a operations manager

# *Human resource management*

**The people employed by an organization either work directly to create a good or service or provide support to those who do. People and the way they are managed are a key resource of all organizations.**

# *Asset management*

- **An organization's buildings, facilities, equipment and stock are directly involved in or support the operations function**

# Break Even Analysis

**Break Even Analysis is the concept that links capacity to cost.It explains the significance of having greater productive capacity to lower cost and maximize profit or contribution.**

**Breakeven point is that at which the contribution margin is able to cover total fixed cost.**

# Break Even Analysis

Let:

**F-Fixed cost of production**

**v-variable cost of production per unit.**

**p-selling price of per unit of the product.**

**c-contribution of one unit of product towards fixed cost.**

**S-sales volume required to achieve break even.**

**Contibution margin c=p-v**

**BEP S=F/c**

# *Cost management*

**Most of the costs of producing goods or services are directly related to the costs of acquiring resources, transforming them or delivering them to customers**

# Decision making

**Decisions need to be made in:**

- **designing the operations system**
- **managing the operations system**
- **improving the operations system.**

# Decision making

**The five main kinds of decision in each of these relate to:**

- **the processes by which goods and services are produced**
- **the quality of goods or services**
- **the quantity of goods or services (the capacity of operations)**
- **the stock of materials (inventory) needed to produce goods or services**
- **the management of human resources.**

# Designing of Product & Process

# PURPOSE OF DESIGN

- **Produce a technological solution to a need!**
  - **Create a physically recognizable object.**
  - **Create an object with economic worth and financial feasibility.**
  - **Choose an optimum alternative solution.**
  - **Develop a new way to do something.**
  - **Reduce cost, inconvenience, improve safety.**
  - **Produce convenience, service, value.**

# Product Design

- **Product design must support product manufacturability (the ease with which a product can be made)**
- **Product design defines a product's characteristics of;**
  - **appearance,**
  - **materials,**
  - **dimensions,**
  - **tolerances, and**
  - **performance standards**

# Design of Services versus Goods

- **Service design is unique in that the service and entire service concept are being designed**
  - **must define both the service and concept**
  - **Physical elements, aesthetic & psychological benefits**

    **e.g. promptness, friendliness, ambiance**

# The four "C's of Design

- **Creativity**
  - **Requires creation of something that has not existed or not existed in the proposed state.**
- **Complexity**
  - **Requires decisions on many variables & parameters**
- **Choice**
  - **Requires making choices between many possible solutions at all levels, from basic concept to small details.**
- **Compromise**
  - **Requires balancing multiple and sometimes conflicting requirements.**

# Manufacturing and Process Selection

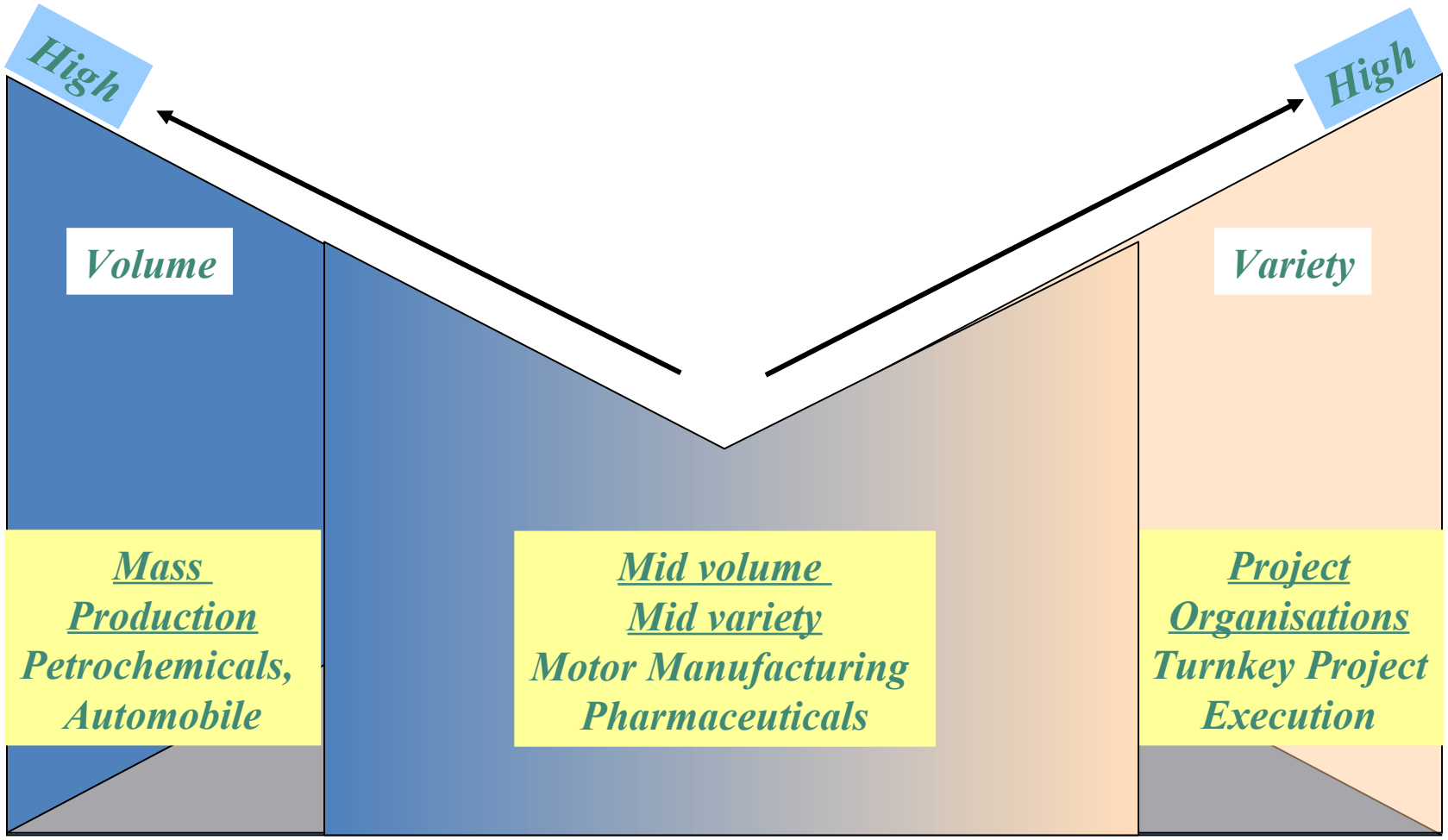
# Factors Influencing Process Choices

- ***Volume*: Average quantity of the products produced in a manufacturing system**
  - **Low volume: Turnkey project management firms such as L&T and BHEL**
  - **High volume: Consumer non-durable and FMCG sector firms, Automobile, Chemical Processing**
  - **Mid-volume: Consumer durables, white goods and several industrial products**

- ***Variety*: Number of alternative products and variants of each product that is offered by a manufacturing system**
  - **Variety of product offerings is likely to introduce variety at various processes in the system; alternative production resources, materials, and skill of workers**

- ***Flow*: Flow indicates the nature and intensity of activities involved in conversion of components and material from raw material stage to finished goods stage**

# Relationship between volume and variety



# Processes & Operations Systems

## Available Alternatives

***Two broad process classifications include***

***Intermittent operations – produce a variety of products in lower volumes***

***Repetitive operations – produce one or a few standardized products in high volume***

# Process Selection

- **Process selection is based on five considerations**
  - **Type of process; range from intermittent to continuous**
  - **Degree of vertical integration**
  - **Flexibility of resources**
  - **Mix between capital & human resources**
  - **Degree of customer contact**

# Process Selection

- Process types can be:
  - **Project process /Job Shop**– make a one-at-a-time product exactly to customer specifications
  - **Batch process** – small quantities of product in groups or batches based on customer orders or specifications

# Process Selection

- **Line process** – large quantities of a standard product

- **Continuous process** – very high volumes of a fully standard product

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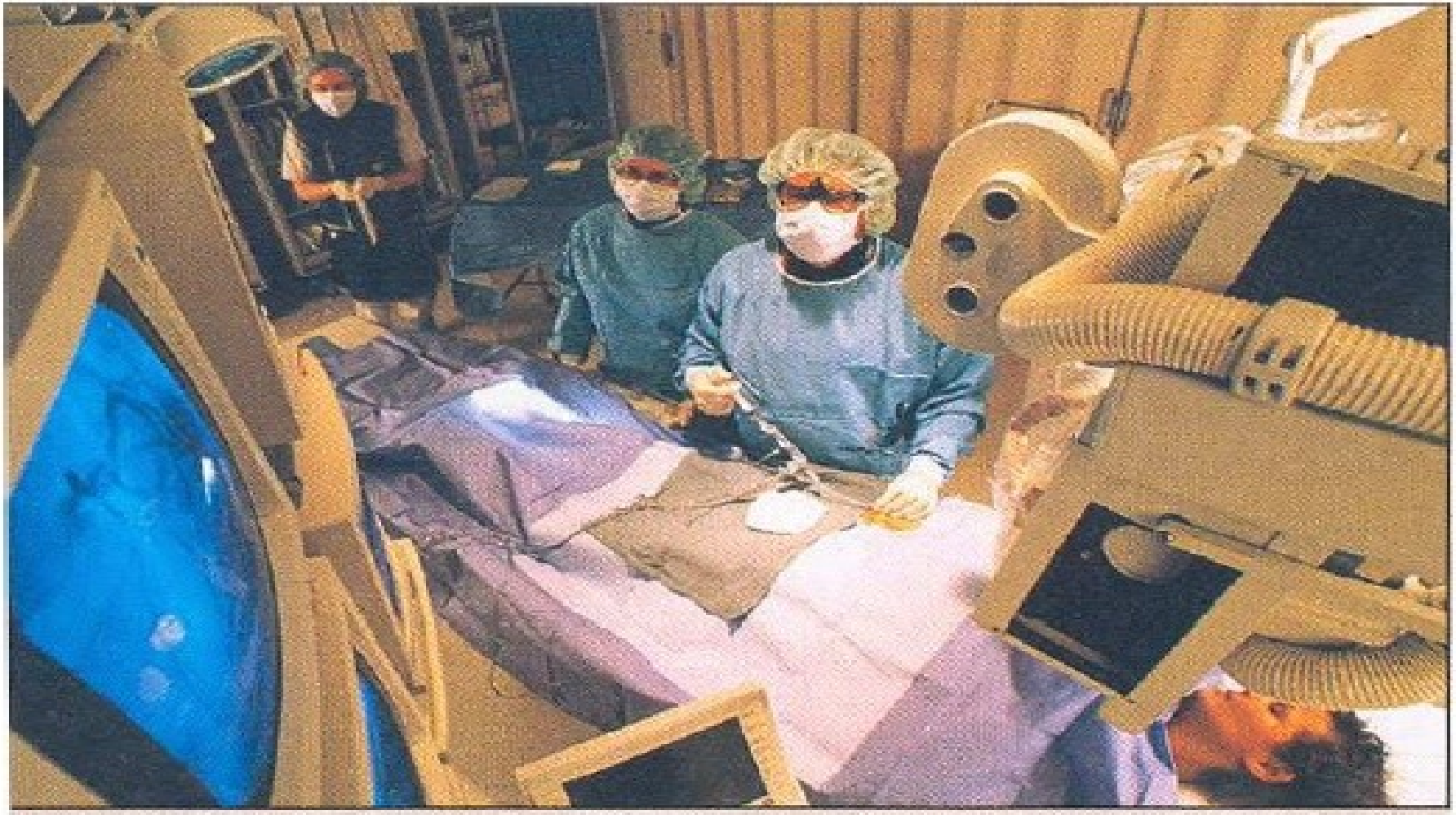
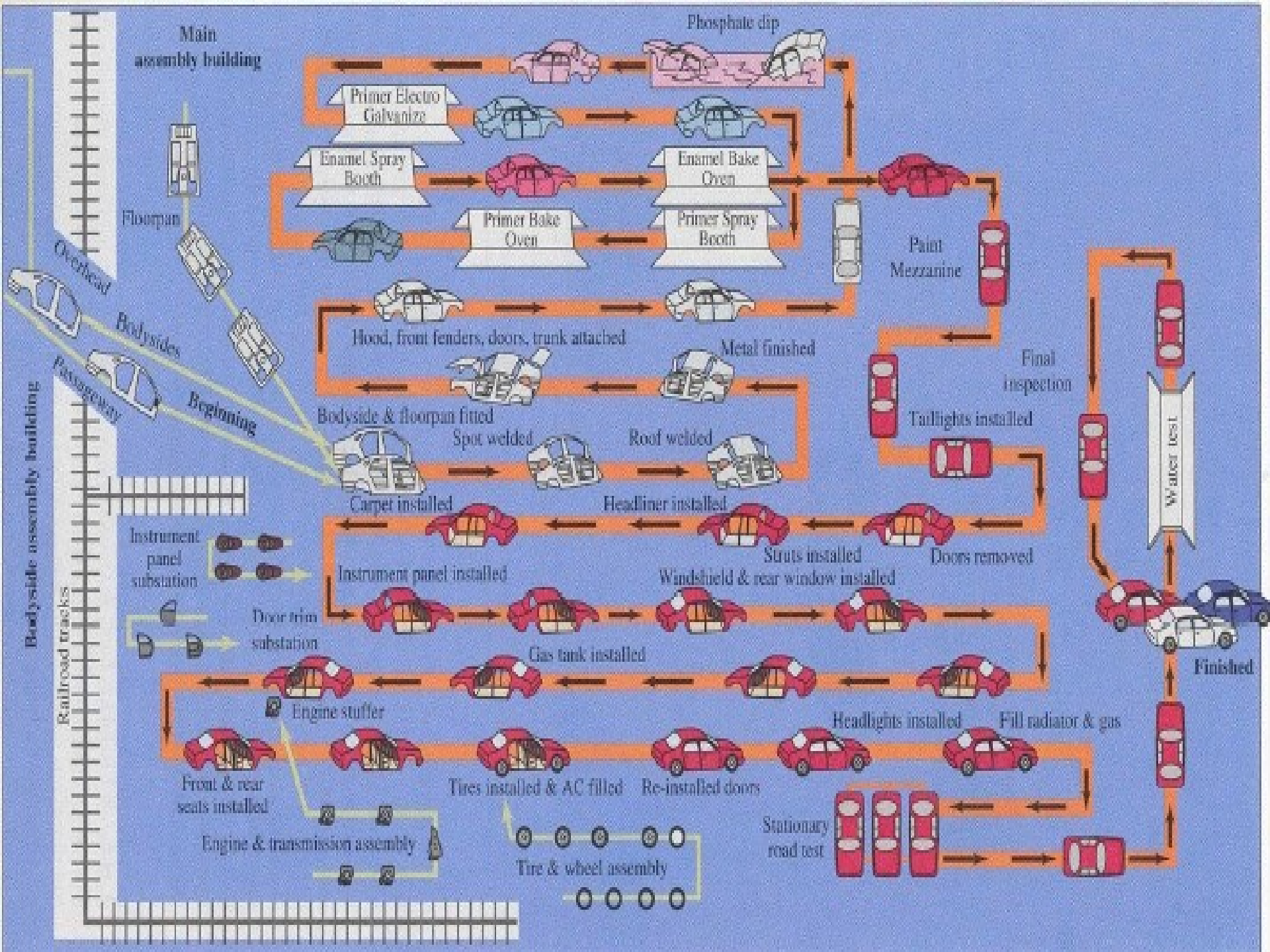
# Job Shop: Hospital



*A job shop process: A Midwestern hospital medical team performs a diagnostic procedure involving a cardiac catheterization.*

# Assembly Line: Electronic boards

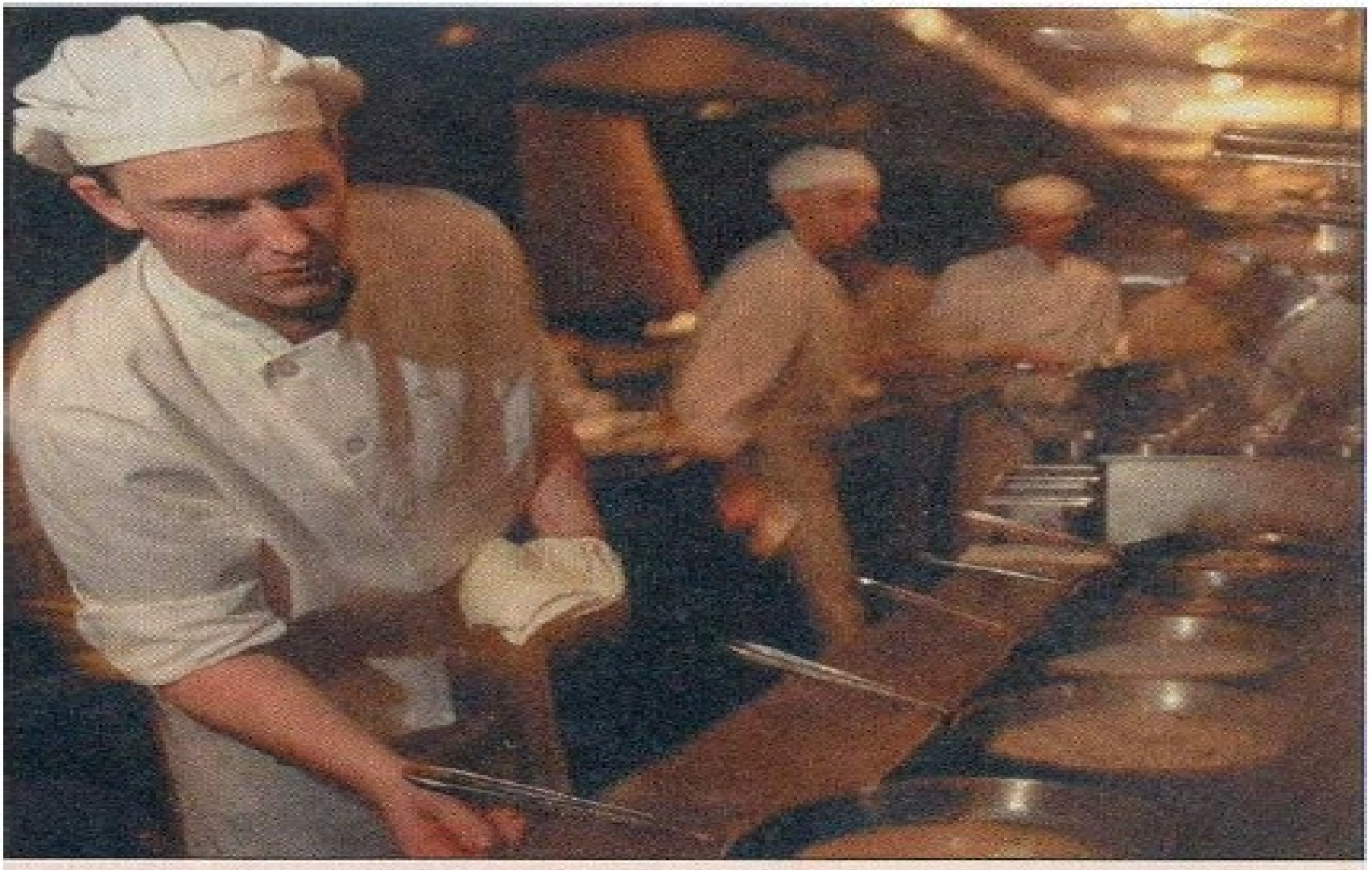

Factory workers in Dong Guan, Guangdong Province, China, assemble electronic boards. Each worker performs the same set of tasks at her station on each electronic board that is assembled.


Main assembly building
Phosphate dip
Primer Electro Galvanize
Enamel Spray Booth
Enamel Bake Oven
Primer Bake Oven
Primer Spray Booth
Paint Mezzanine
Floorpan
Overhead
Bodysides
Passageway
Beginning
Hood, front fenders, doors, trunk attached
Metal finished
Final inspection
Bodyside & floorpan fitted
Spot welded
Roof welded
Taillights installed
Carpet installed
Headliner installed
Struts installed
Doors removed
Instrument panel substation
Instrument panel installed
Windshield & rear window installed
Door trim substation
Gas tank installed
Finished
Engine stuffer
Headlights installed
Fill radiator & gas
Front & rear seats installed
Tires installed & AC filled
Re-installed doors
Stationary road test
Engine & transmission assembly
Tire & wheel assembly
Bodyside assembly building
Railroad tracks
WABASH

# Continuous Process: Beer

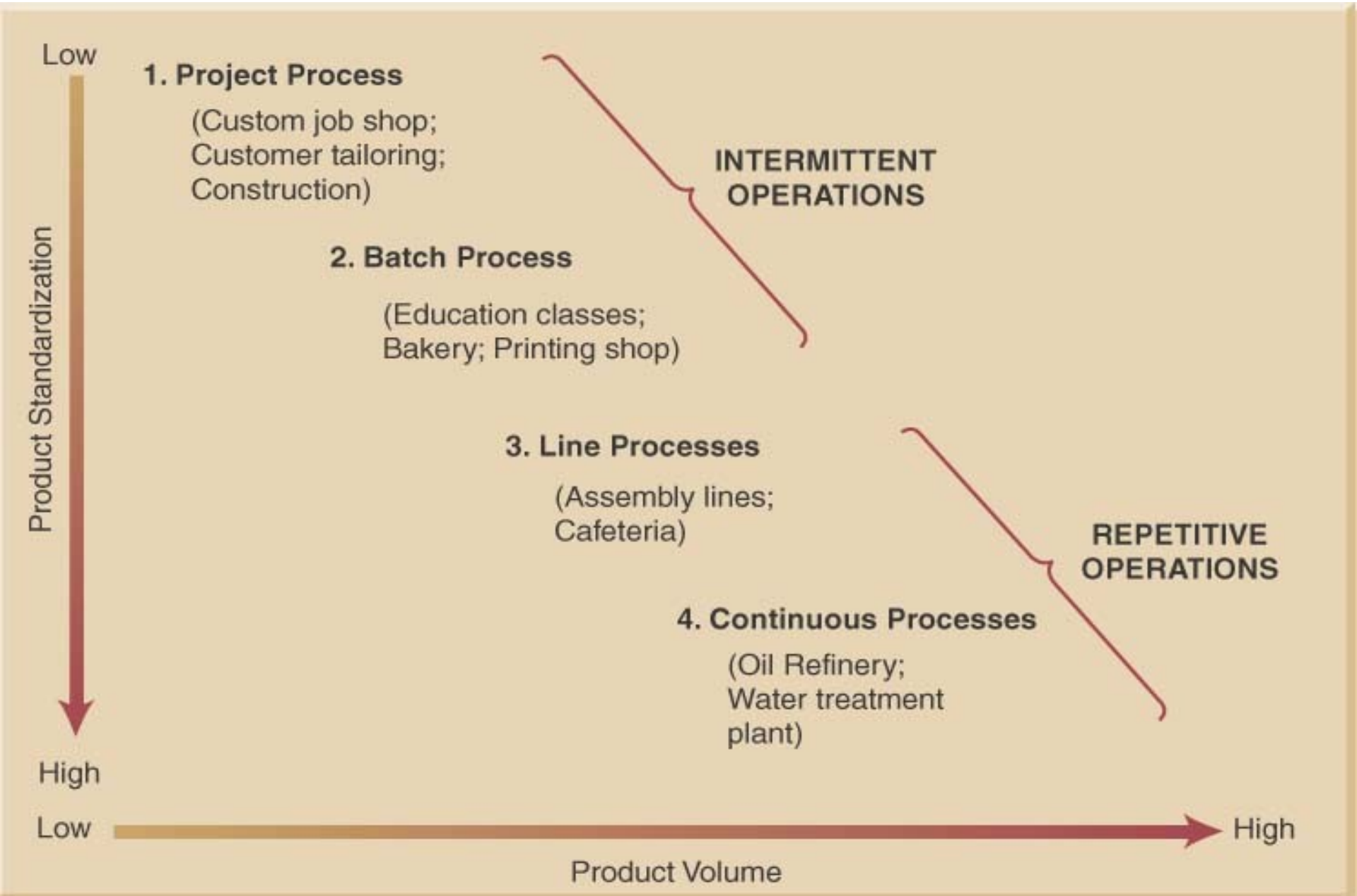

THE MILLER BREWING COMPANY USES A CONTINUOUS PRODUCTION PROCESS. BEER IS BREWED, BOTTLED, PACKAGED, AND SHIPPED ON ONE LONG PRODUCTION LINE WITH SPECIALIZED AUTOMATED EQUIPMENT.

# Batch Process: Mid-scale restaurant



*A batch process. Food preparation, one menu item at a time, in the kitchen of the Spago Restaurant in the Forum at Caesar's Palace, Las Vegas, Nevada.*

# Underlying Process Relationship Between Volume and Standardization Continuum



# Differences between Intermittent and Repetitive Operations

| *Decision* | *Intermittent Operation* | *Repetitive Operation* |
|---|---|---|
| *Product variety* | *Great* | *Small* |
| *Degree of standardization* | *Low* | *High* |
| *Organization of resources* | *Grouped by Function* | *Line flow* |
| *Path of products* | *Varied, depends on product* | *Line flow* |
| *Factor driving production* | *Customer orders* | *Forecast of demand* |
| *Critical resource* | *Labor* | *Capital* |
| *Type of equipment* | *General purpose* | *Specialized* |
| *Degree of automation* | *Low* | *High* |
| *Throughput time* | *Longer* | *Shorter* |
| *Work-in-process inventory* | *More* | *Less* |

# Designing Processes

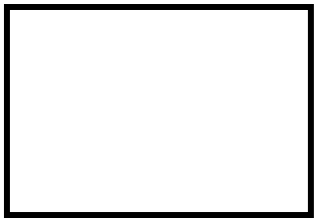
- Process design tools include
  - Process flow analysis
  - Process flowchart (Also used to evaluate and improve processes.)
- Design considerations include
  - Make-to-stock strategy
  - Assemble-to-order strategy
  - Make-to-order strategy

# Process Design Tools

- **Process flow analysis is a tool used to analyze and document the sequence of steps within a total process. Usually first step in Process Reengineering.**

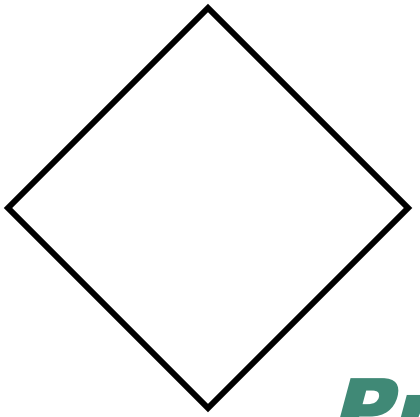
- **Process Re-engineering is a structured approach used when major business changes are required as a result of:**
  - **Major new products**
  - **Quality improvement needed**
  - **Better competitors**
  - **Inadequate performance**

# Flowchart Symbols



*Tasks or operations*

***Examples: Giving an admission ticket to a customer, installing a engine in a car, etc.***



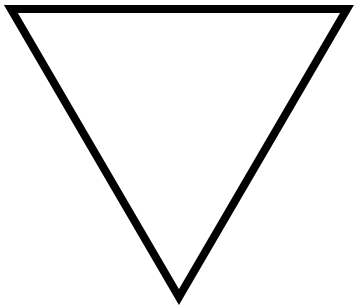
*Decision Points*

***Examples: How much change should be given to a customer, which wrench should be used, etc.***

# Process Analysis Terms

***Process: Is any part of an organization that takes inputs and transforms them into outputs***

# Flowchart Symbols



*Storage areas or queues*

*Examples: Sheds, lines of people waiting for a service, etc.*

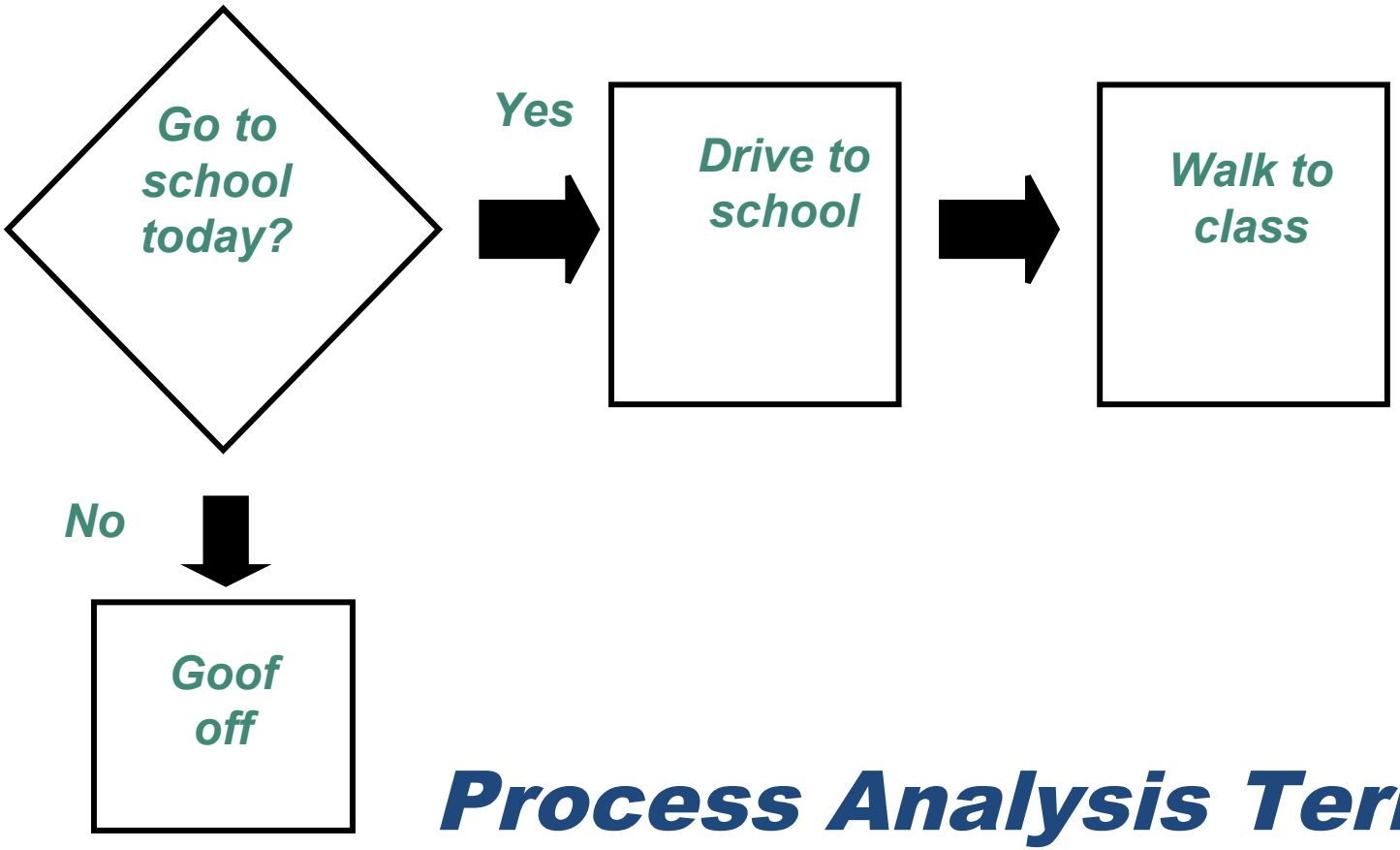
*Flows of materials or customers*

*Examples: Customers moving to a seat, mechanic getting a tool, etc.*

# Process Analysis Terms

*Cycle Time: Is the average successive time between completions of successive units*

# Example: Flowchart of Student Going to School



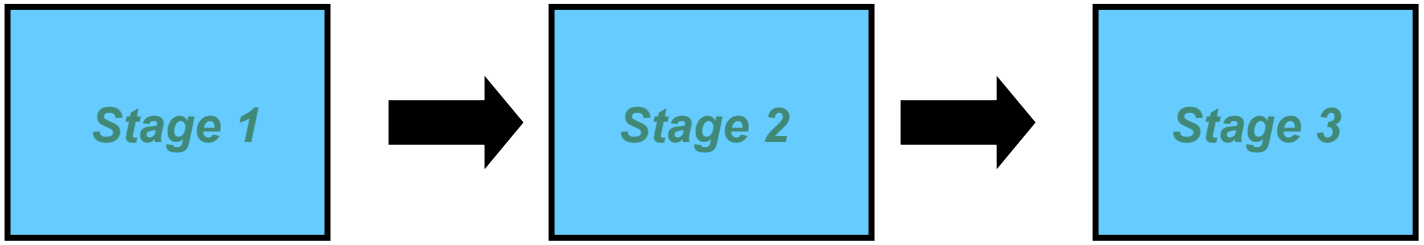

## Process Analysis Terms

- *Utilization: Is the ratio of the time that a resource is actually activated relative to the time that it is available for use*

# Types of Processes

## *Single-stage Process*


## *Multi-stage Process*




## *Other Process Terminology*

***Blocking***

***Occurs when the activities in a stage must stop because there is no place to deposit the item just completed***

***Starving***

***If an employee is waiting at a work station and no work is coming to the employee to process.***

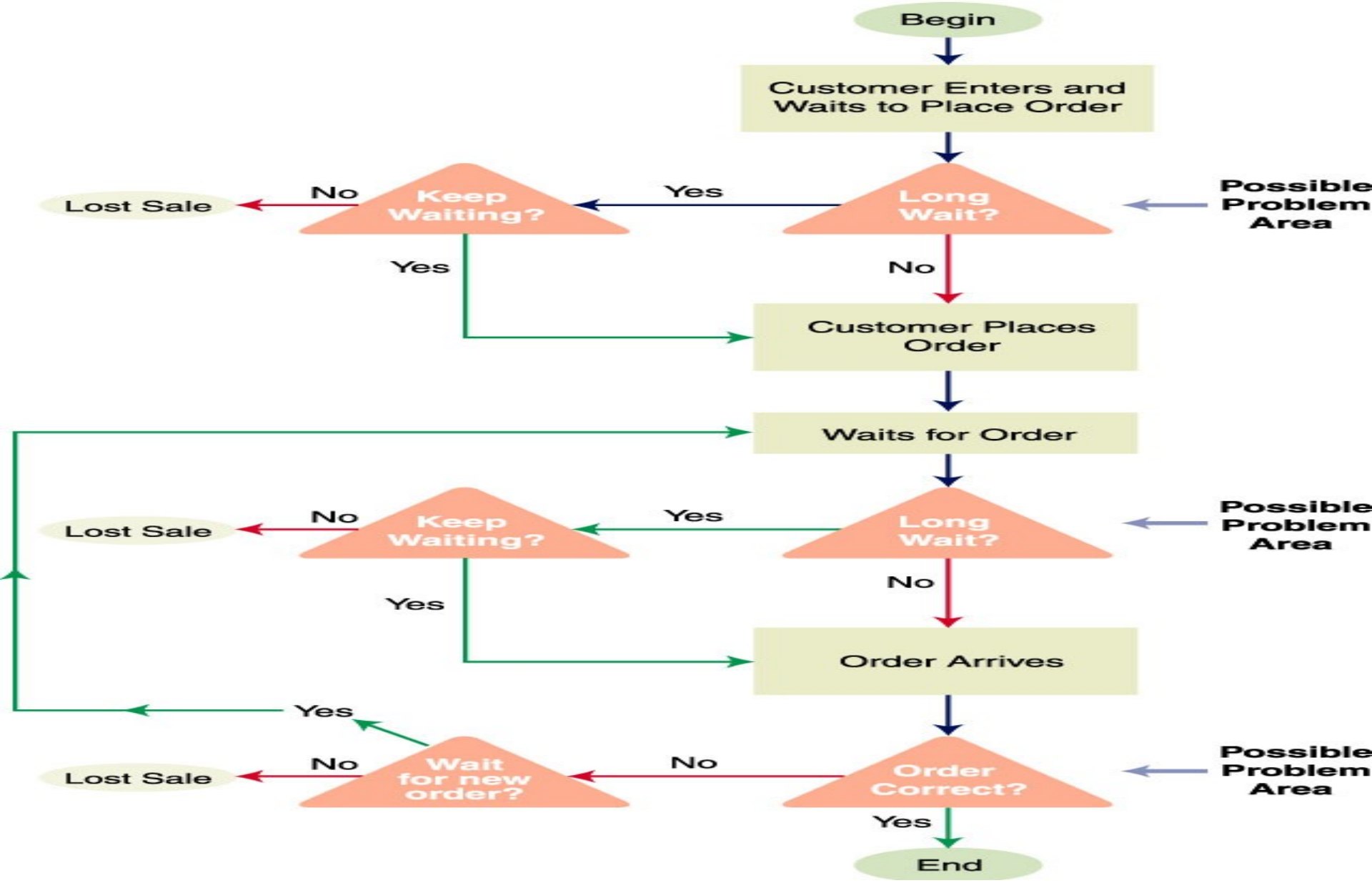
# Other Process Terminology

- **Bottleneck**
  - **If an employee works too slow in a multi-stage process, work will begin to pile up in front of that employee. In this is case the employee represents the limited capacity causing the bottleneck.**
- **Pacing**
  - **Refers to the fixed timing of the movement of items through the process**

**A buffer refers to a storage area between stages where the output of a stage is placed prior to being used in a downstream stage**

- **Make-to-order**
  - **Only activated in response to an actual order**
- **Make-to-stock**
  - **Customer orders are served from target stocking level**

# Process Design Tools



# Process Performance Metrics

- **Operation time = Setup time + Run time**
- **Throughput time = Average time for a unit to move through the system**
- **Velocity = $\frac{\text{Throughput time}}{\text{Value-added time}}$**
- **Cycle time = Average time between completion of units**
- **Throughput rate = $\frac{1}{\text{Cycle time}}$.**
- **Efficiency = $\frac{\text{Actual output}}{\text{Standard Output}}$**

# Process Performance Metrics (Cont.)

- **Productivity = $\frac{\text{Output}}{\text{Input}}$**

- **Utilization = $\frac{\text{Time Activated}}{\text{Time Available}}$**

## *Process Throughput Time Reduction*

*Perform activities in parallel*

*Change the sequence of activities*

*Reduce interruptions*

# Process Performance Metrics

| Measure | Definition |
| --- | --- |
| 1. Throughput time | Average amount of time product takes to move through the system. |
| 2. Process velocity $= \frac{\text{Throughput time}}{\text{Value-added time}}$ | A measure of wasted time in the system. |
| 3. Productivity $= \frac{\text{Output}}{\text{Input}}$ | A measure of how well a company uses its resources. |
| 4. Utilization $= \frac{\text{Time a resource used}}{\text{Time a resource available}}$ | The proportion of time a resource is actually used. |
| 5. Efficiency $= \frac{\text{Actual output}}{\text{Standard output}}$ | Measures performance relative to a standard. |