



# Production System

## Traditional Production System

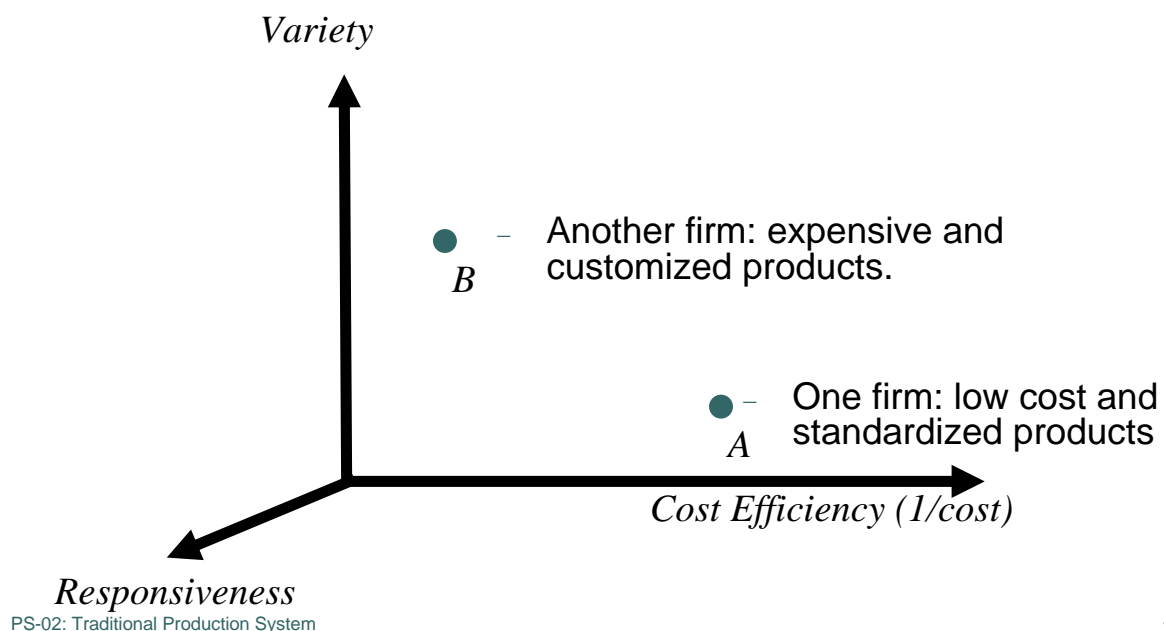


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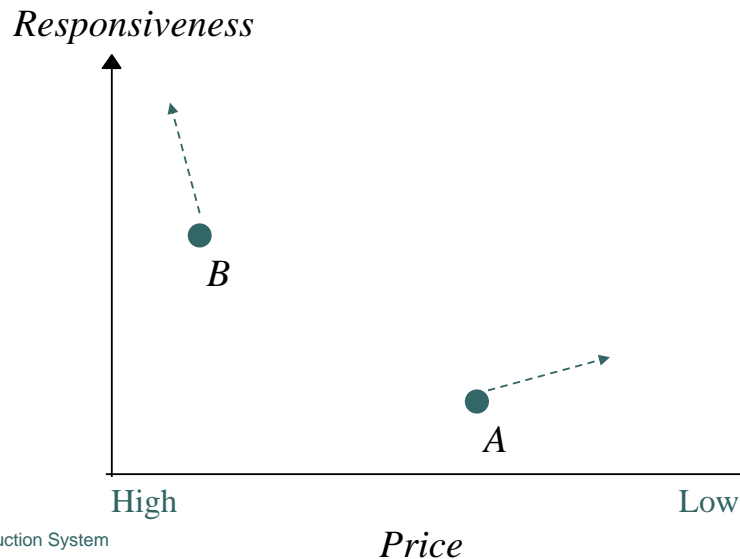
## Competitive Product Space

- A representation of the firm's product portfolio in the **four dimensional space**: *Q*, *C*, *Var.*, *Res.*



## ●●● | Strategic Positioning

- Defines those positions that the firm wants to occupy in its competitive product space. The current position, direction, and goal position.



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## ●●● | Manufacturing System Typology

- Manufacturing systems are classified in different ways:
  - Process positioning strategy
    - based on production process
  - Product positioning strategy
    - Based on the interaction with the consumer

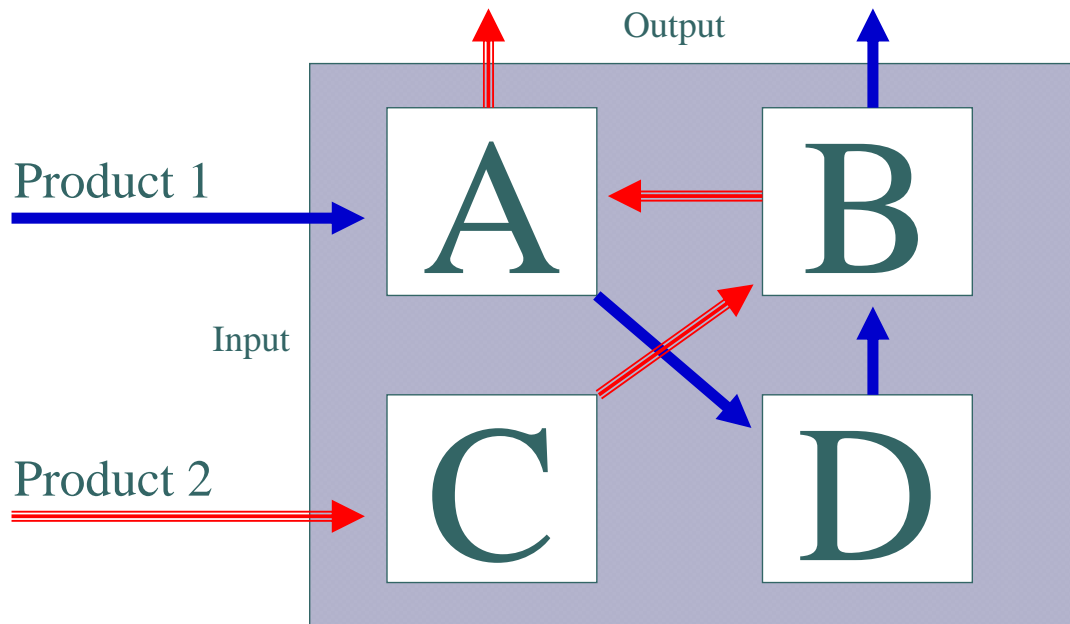
# ●●● | Manufacturing System Typology

- Typology 1
  - Evaluates based on how production process is physically arranged in a factory
  - Depicts how the product flow is processed
- Typology 2
  - Evaluates the interaction between producer and consumer on how the order is being sent and received (*Consumer Order Decoupling Point*)
  - Depicts how the inventory is maintained

# ●●● | Typology I

- Process Architecture refers to
  - **Physical layout** of resources
  - **Flexibility** of resources
- Most process architectures fall somewhere on the continuum between job shop and flow shop

## ●●● | Process Architectures: Job Shop



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## ●●● | Job Shop

- Functional layout or Process layout:
  - similar resources in the same department.
  - Ex. all press machines are located in stamping department
- Ex. Bakeries, law firms, emergency rooms, repair shops.

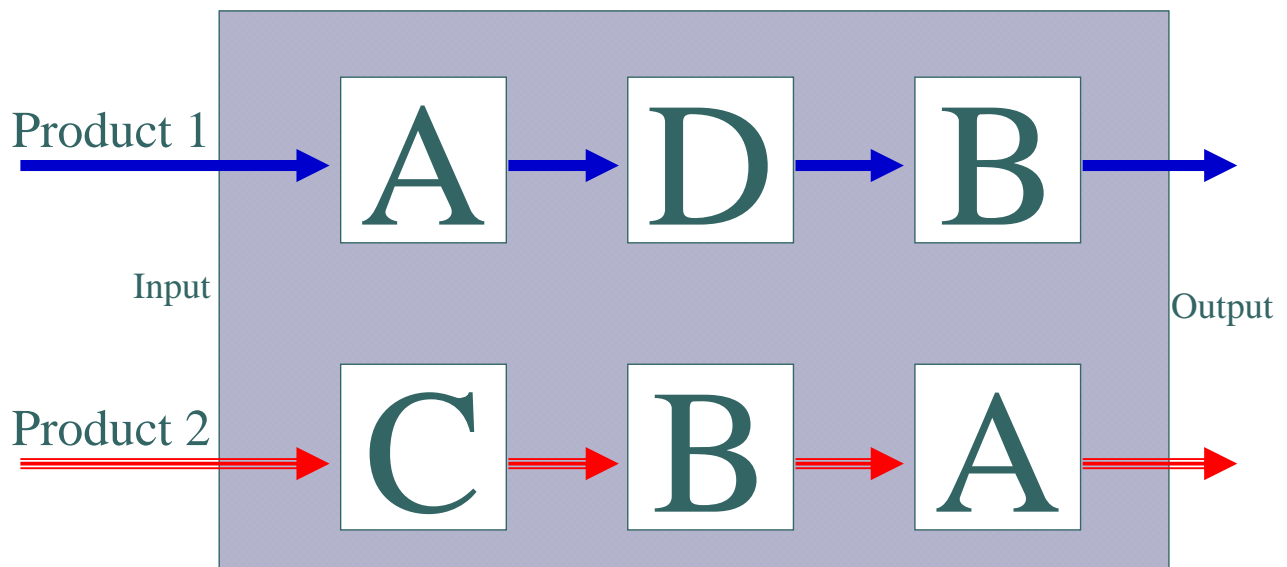
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## ●●● | Job Shop Characteristics

- low volume, high variety customized products
- flexible resources
- skilled human resources
- jumbled work flows
- high material handling
- large of inventories
- long flow time
- highly structured information system
- high cost per unit of product but low investment

## ●●● | Process Architectures: Flow Shop



## ●●● | Flow Shop

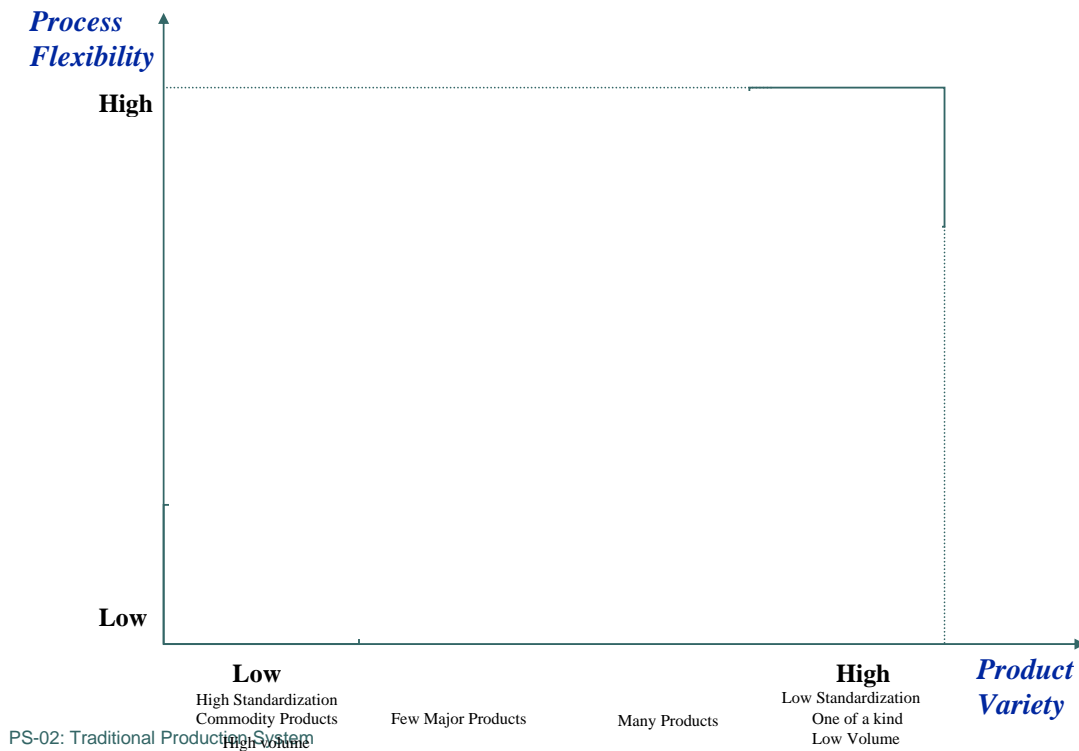
- Product layout or line layout:
  - Resources are arranged according to the sequence of the operations.
  - Usually requires duplication (and investment) of a resource pool; dedication of resources.
- Discrete flow shop:
  - assembly line
- Continuous flow shop:
  - beverage, chemical plant, process plant.

## ●●● | Flow Shop Characteristics

- high standardization, high speed
- low material handling
- short flow time
- low unit-processing costs
- high investment cost; needs mass production.
- special purpose equipment, and low skilled labor prevent flexibility



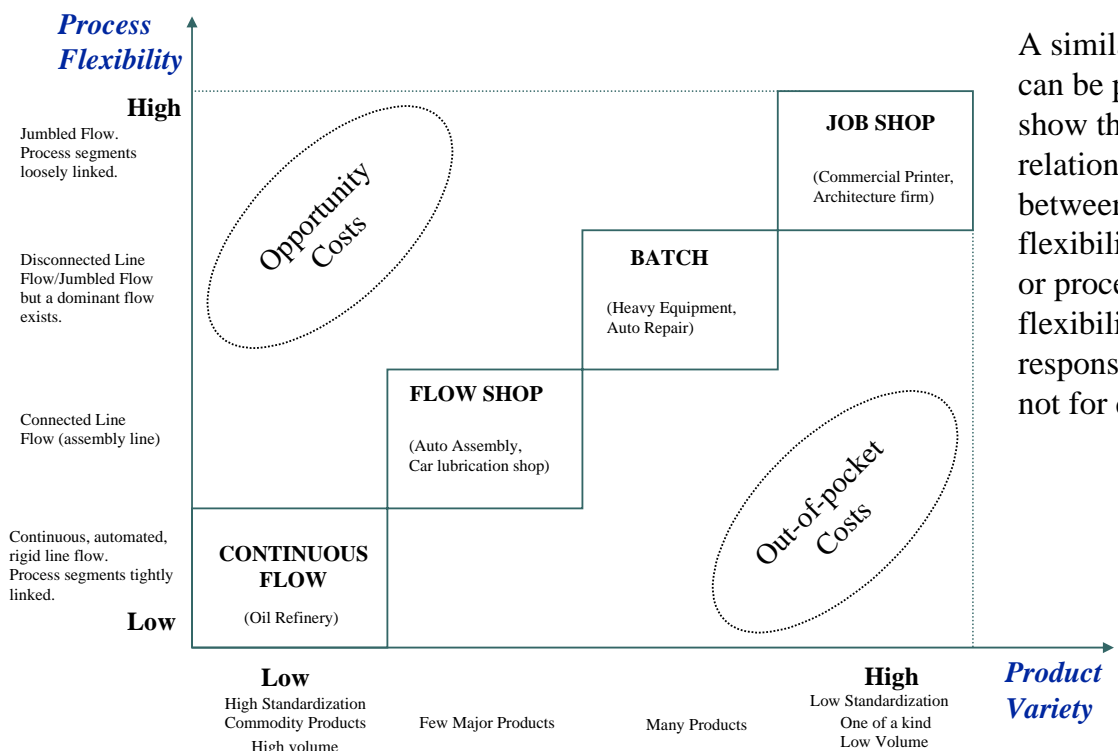
# Matching Process Choice with Strategy: Product-Process Matrix



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# Matching Process Choice with Strategy: Product-Process Matrix



A similar graph can be prepared to show the relationship between process flexibility and cost, or process flexibility and response time, but not for quality.

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## ●●● | Matching Process Choice with Strategy: Product-Process Matrix

	Low Volume One of a Kind	Multiple Products, Low Volume	Few Major Products, Higher Volume	High Volume, High Standardization	
I. Job Shop					Flexibility (High) Unit Cost (High)
II. Batch					
III. Assembly Line					
IV. Continuous Flow					

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## ●●● | ABOVE THE DIAGONAL

- Flexibility/Variety is Higher
- Costs are Higher
- OK with low volume markets
- OK when high customization is necessary
- Threats:
  - A competitor can undercut you
  - Risky when high volume can be stimulated through price competition

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## ●●● | BELOW THE DIAGONAL

- Costs are lower
- Automation is higher
- Greater investment
- Threats:
  - Greater market risk – what do you do with an automated highly specialized plant when demand decreases?
  - Competition may match costs with greater product variety.

## ●●● | Characteristics of Processes: Job Shop vs. Batch vs. Flow Shop

Type of Process	Product Volume	Specialized Equipment	Product Variety	Machine Setup Frequency	Labor Skills	Variable Cost
<b>Job Shop</b>						
<b>Batch</b>						
<b>Flow Shop</b>						

Most processes fall somewhere on the continuum between Job Shop and Flow Shop



## Characteristics of Processes: Job Shop vs. Batch vs. Flow Shop

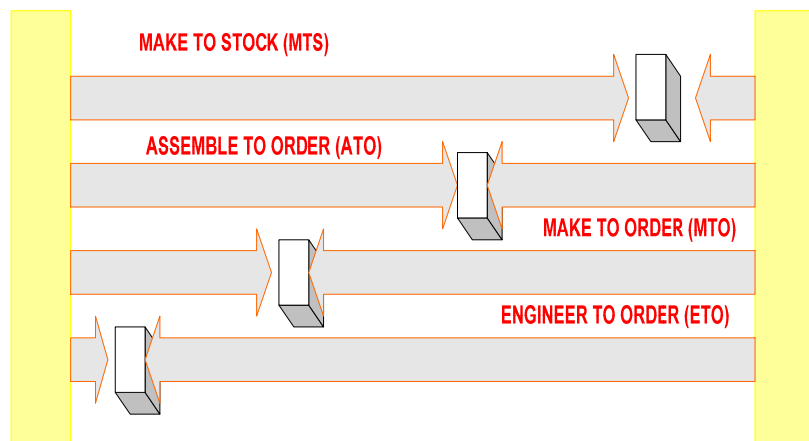
	<i>Project</i>	<i>Job shop</i>	<i>Repetitive</i>	<i>Line</i>	<i>Continuous</i>
Process speed	Varies	Slow	Moderate	Fast	Very fast
Labor content	High	High	Medium	Low	Very low
Labor skill level	High	High	Moderate	Low	Varies
Order quantity	Very small	Low	Varies	High	Very high
Unit quantity cost	Very large	Large	Moderate	Low	Very low
Routing variations	Very high	High	None	Low	Very low
Product options	Low	Low	None	Very high	Very low
Design component	Very large	Large	Very small	Moderate	Small

All manufacturing falls on this continuum.



## Typology 2



### ○ ETO -> MTO-> ATO-> MTS

- Function of Competitive/Corp. Strategy, Homogeneity of Product, Price, Quality, Speed, Flexibility, and Service.



# Tipologi Sistem Manufaktur

ASPECT	MTS	ATO	MTO	ETO
Interface between manufacturer and customer	Less interface	Sales dept.	Engineering and sales Dept.	Engineering Dept.
Delivery time	Short	Medium	Variable	Variable
Production Volume	High	Medium	Low	Very low
Product variety	Medium	High	Low	Very low
Delivery order estimate	Based on stock availability of finish product	Based on stock availability of component and sub-assembly product	Based on availability of production capacity	Based on availability of engineering and production capacity



# Tipologi Sistem Manufaktur

ASPECT	MTS	ATO	MTO	ETO
Unit in Master Production Schedule	Sales unit	Major components	End products	End products
Assembly schedule	MPS dependent	Consumer dependent	Covers most of the assembly operation	Covers all of the assembly operations
Structure of Bill of Material	Standard BOM	Planning BOMs are used	Unique BOM for each customer order	Unique BOM for each customer order

# ●●● | Tipologi Sistem Manufaktur

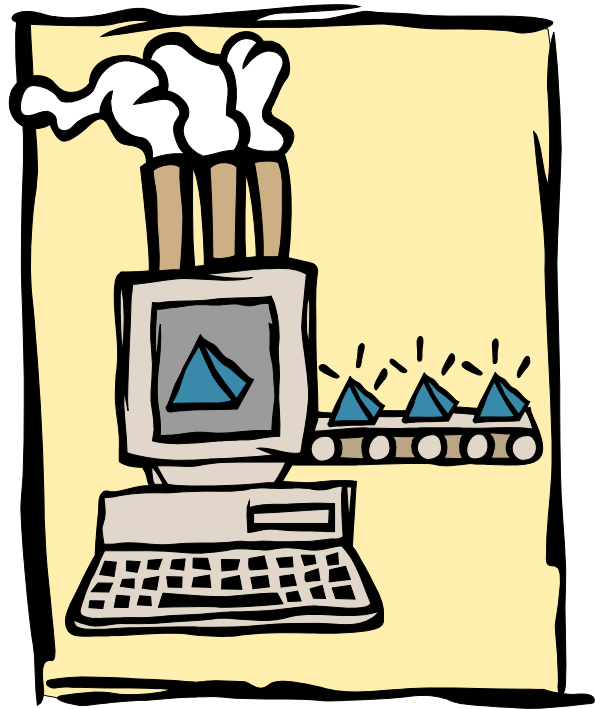
ASPECT	MTS	ATO	MTO	ETO
Basis for production planning	Forecasting	Forecasting and backlog	Backlog and customer order	Customer order
Handling of uncertainty (demand)	Safety stock	Over planning of component and sub-assembling	Little uncertainty exist	No handling

# ●●● | The Problem of Manufacturing...

- Getting the right material and physical resources together at the right place and at the right time to meet the customer's requirements.
- Desired features, On time delivery, High Quality, at the best price...

## ●●● | Breaking down the problem...

- Getting the material needed...
- Having enough inventory of material to support production
- Not having too much inventory and extra costs...



## ●●● | The name of the game...

- Material Requirement Planning
  - Inventory control -> MRP -> MRP II -> ERP
- Just in Time
  - Toyota Production System
  - Synchronous Mfg.
- Lean Manufacturing
  - Lean Production
  - Agile manufacturing
- Computer Integrated Manufacturing
  - Computer Aided Design
  - Computer Aided Manufacturing
  - Computer Aided ... etc.



## What can you expect in the real world?



- It may not be as easy as you think!
- Continual changes