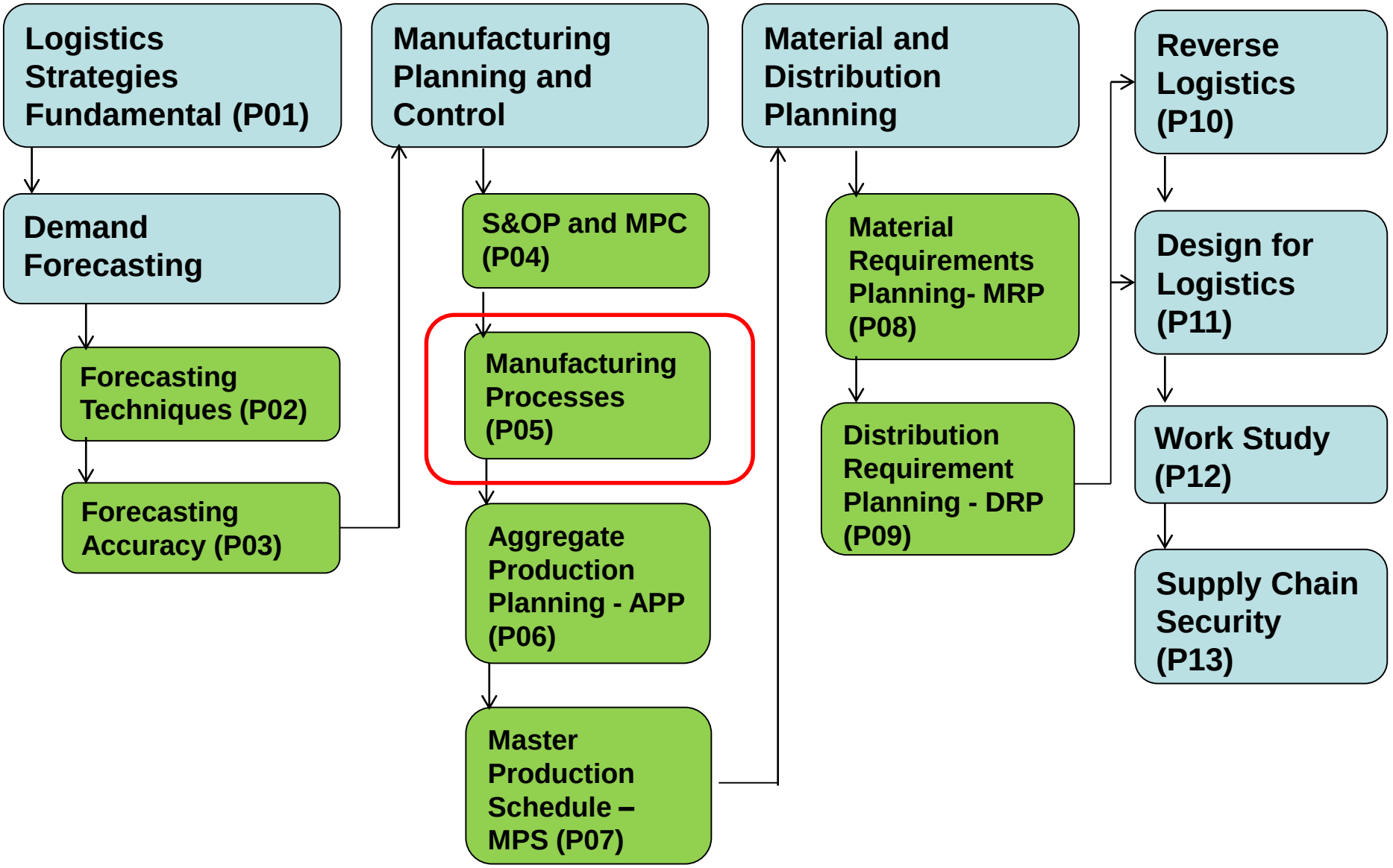
Problem 05
Types of Manufacturing Processes

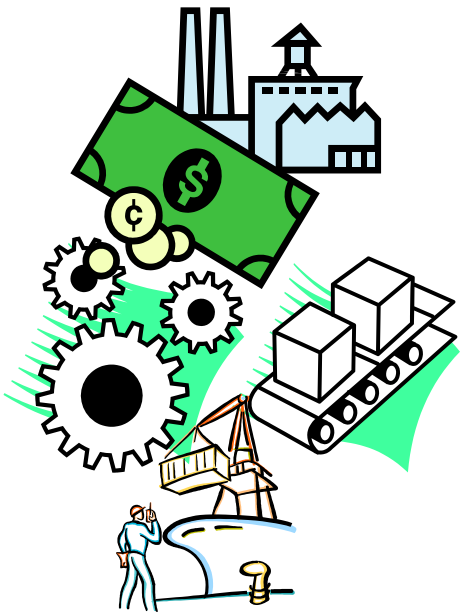
SCHOOL OF ENGINEERING

E222 – Logistics Planning and Control

E222 Logistics Planning and Control – Topic Tree



P05 – Types of Manufacturing Processes



- Explain Process Selection criteria
- Identify Manufacturing Process Types
  - Job Shop
  - Batch
  - Assembly Line
  - Flow
- Elaborate the Manufacturing Process Characteristics
- Explain the effect of 3D printing on Supply Chain

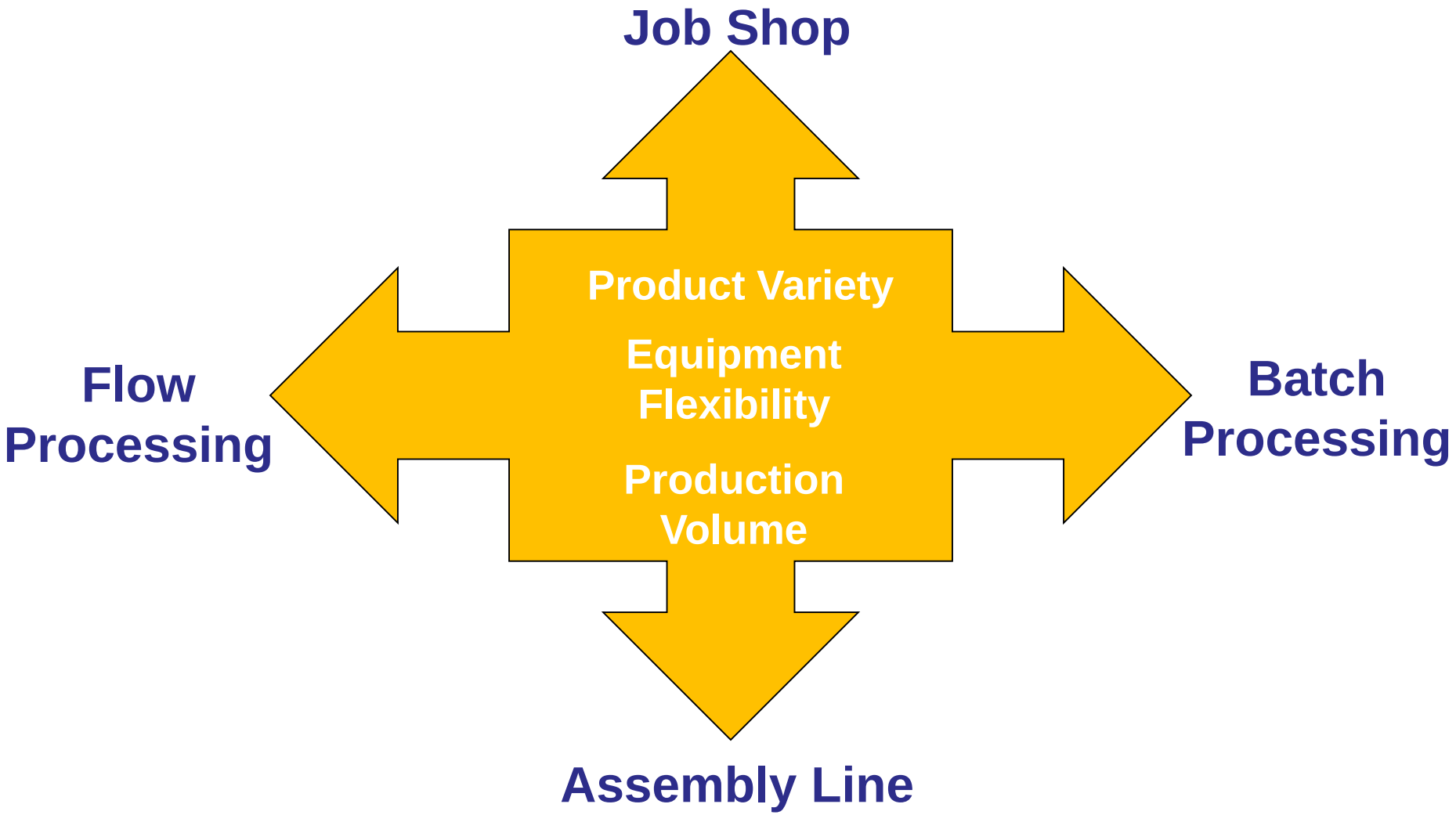
Manufacturing Process

- **Manufacturing Process:** the conversion of inputs (raw materials) into outputs (finished goods); core of operation management

Process Selection Criteria

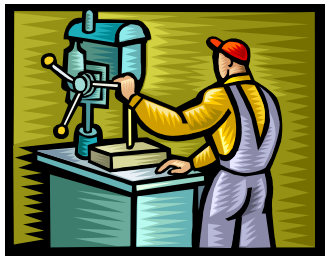
- Also known as Manufacturing Variables
- **Product Variety:** How much the product changes from customer to customer.
- **Equipment Flexibility**: Whether equipment provides very specialized function or has the flexibility to provide certain level of product differentiation
- **Production Volume:** Some products are produced on small volume depending on customer needs, while others are produced in huge quantities in anticipation of customer demand

Manufacturing Process Types



Job Shop

- For highly specialized product in low volume on customer-order basis
- Equipment must be flexible enough to change with each new job
- Jumbled flow – each product is made in a different sequence of activities
  - E.g. Computer Aided Manufacturing (CAM) workshop which produces wide variety of parts based on specific customer order (usually low volume)



Batch Processing

- For higher volume product with standard product design and a few product ‘types’
- Disconnected production line flow – produced in small lots or batches
- Uses flexible equipment (adjustable for multiple tasks) to produce a variety of products in moderate volume
  - E.g. Shoes, pharmaceutical products

Assembly Line

- Small variety of highly standardized product to be produced in large volume
- Originated by Henry Ford for automobile production in 1913
- Uses a connected line for production & moves the product along the line
  - E.g. On a conveyor system along a series of work stations
- Structured with each line producing only one type of product

- Cannot easily switch product, but there are options to offer some variety on the product being produced
  - E.g. Car assembly lines, electrical appliances

Flow Processing

- For very standardized product in very large volume in the most cost-effective manner
- Like assembly line, flow processing has a fixed pace and fixed sequence of activities.
- Each piece of equipment performs a specific function & seldom modified for special needs
- Quantity of product is measured in weight or volume
  - Eg. Steel plant, oil refineries

Manufacturing Process Types (Pros and Cons)

	Job Shop	Batch	Assembly Line	Flow
Description	Customized goods or services	Semi-standardized goods or services	Standardized goods or services	Highly standardized goods or services
Merits 	Able to handle a wide variety of work	Flexibility	Low unit cost, high volume and efficient	Very efficient, very high volume
Limitations 	Slow, high cost per unit, complex planning and scheduling	Moderate cost per unit, moderate scheduling complexity	Low flexibility, high cost of downtime	Very rigid, lack of variety, costly to change, very high cost of downtime

Manufacturing Process Types (Criteria)

	Job Shop	Batch	Assembly Line	Flow
Variety	Highest	High	Low	Lowest
Equipment Flexibility	Highest	High	Low	Lowest
Volume	Lowest	Low	High	Highest

Manufacturing Process Types (Characteristics)

	Job Shop	Batch	Assembly Line	Flow
Unit cost	Highest	High	Low	Lowest
Labor content and skill	Highest	High	Low	Lowest
Capital Investment	Lowest	Low	High	Highest

Manufacturing Objectives

- One key manufacturing objective is to achieve the cost advantage of the Flow Process and the product variety and/or customization associated with the Job Shop.
- Most companies operate in between the 4 types of configuration, to achieve optimal production mode and better respond to market changes.
  - E.g. Companies that operate primarily in flow mode will often have repair shops (job shop) to fix equipment that fails.

3D Printing

- 3D Printers can now create customized apparel, personalized make-up and can even be used in medicine.

- In the near future, 3D printing could make massive changes to supply chain process

- How would it affect? Economist has identified 6 areas:

Effect of 3D printing on Supply Chain

- **Global Logistics:**
  - Less global manufacturing needed. This will decrease the quantity of air and ocean freight, as well as demand for international logistics brokers.

- **Inventory Levels:**
  - Products are made only when ordered, which means inventory levels will fall and be reduced in warehouses.

- **Fulfillment:**
  - The made-to-order strategy will also influence the fulfillment process and the role of the retailer. In fact, the entire manufacturer-wholesaler-retailer relationship will change. Since retailers do not need to keep stock of their own, orders can be fulfilled directly through the manufacturer.

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Effect of 3D printing on Supply Chain

- **Stock Location:**
  - With 3D printers, service parts for machinery, cars or medical equipment could be produced in a very short time by downloading the design of spare parts and printing them. This will help save costs that are wasted on holding stock of supply products and eliminate a large number of warehouses and stock locations.

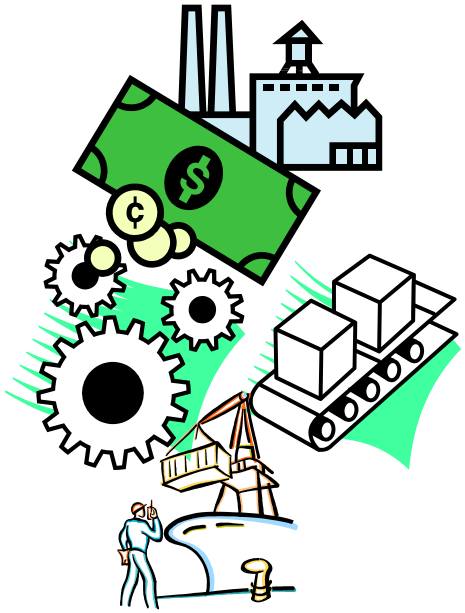
- **Transportation Routes:**
  - 3D printers, if situated close to end users, will help reduce transportation costs greatly. It will also shorten the length of the supply chain and reduce the negative impact on the environment.

- **Consumer Relationships:**
  - The way a consumer relates to companies will continue to evolve with more personalization and fewer mediators. Personalized apparel, furniture and even vehicles will be created and purchased in stores or online.

Current limitations of 3D printing

- Though 3D printing undergo rapid development, it won't necessarily bring an end to traditional manufacturing and the modern supply chain.
- Assembly line production is essential for numerous specialized items.
- Additive manufacturing (3D printing) is ideal for personalized and complex production, but it cannot keep up with mass production.
- Traditional manufacturing processes are cheaper, faster and require less labour

Learning Outcomes



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