

MSIN0095: Operations Analytics

Class 1: Introduction to OM and Process Analysis I

- » OM as Managing Transformation Processes
- » Operations Strategy Meets Corporate Strategy

Class 2: Process Analysis I

- » Introduction to Process Analysis I, Utilization, Little's Law

Class 3: Process Analysis Application

- » Kristen's Cookie Co.

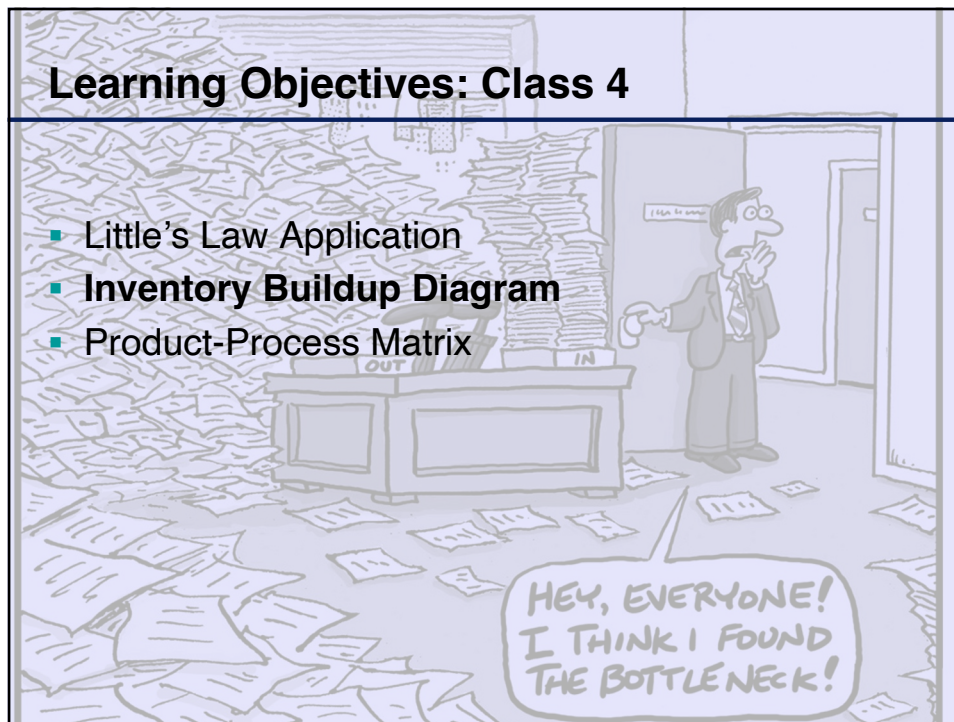
Class 4: Process Analysis III

- » Product Process Matrix, Inventory Build-up

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Learning Objectives: Class 4

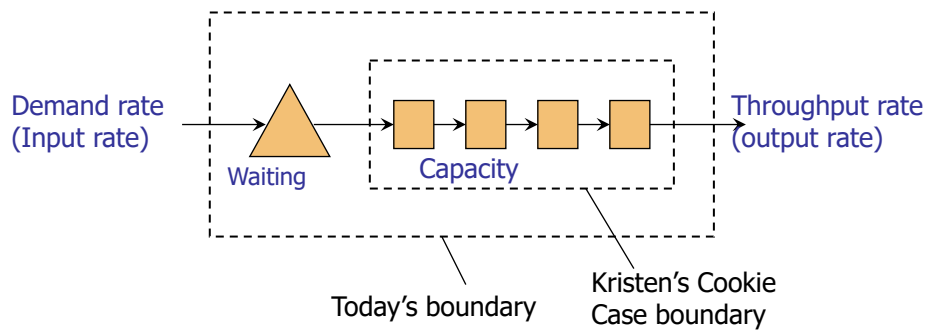
- Little's Law Application
- **Inventory Buildup Diagram**
- Product-Process Matrix



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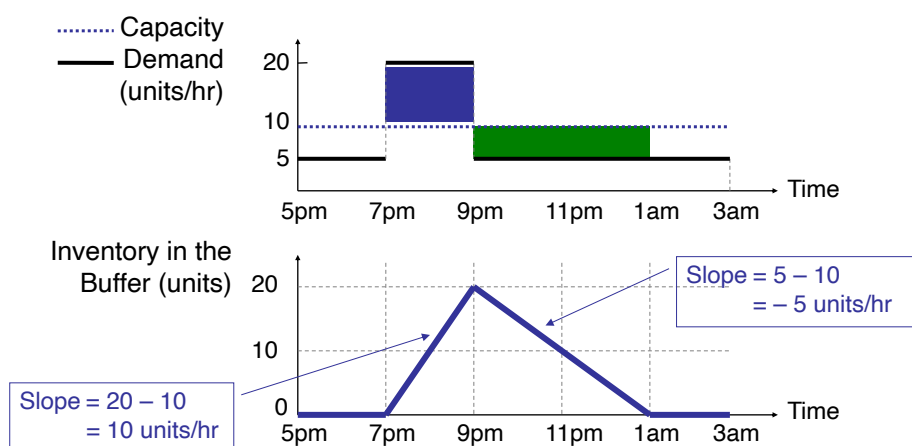
Analyzing buffers and waiting times

- Let us extend the boundary of process analysis:



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Inventory Buildup Diagram



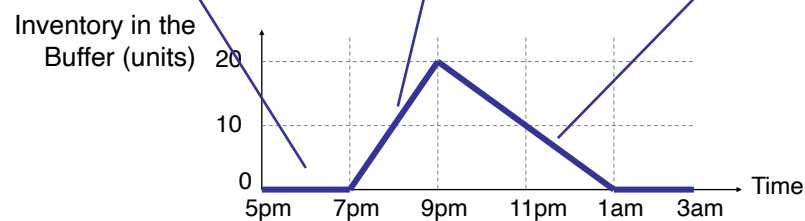
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Inventory Buildup Diagram

- Demand < Capacity
- No inventory
- Throughput rate = Demand rate

- Demand > Capacity
- Inventory buildup rate = Demand - Capacity
- Throughput rate = Capacity rate

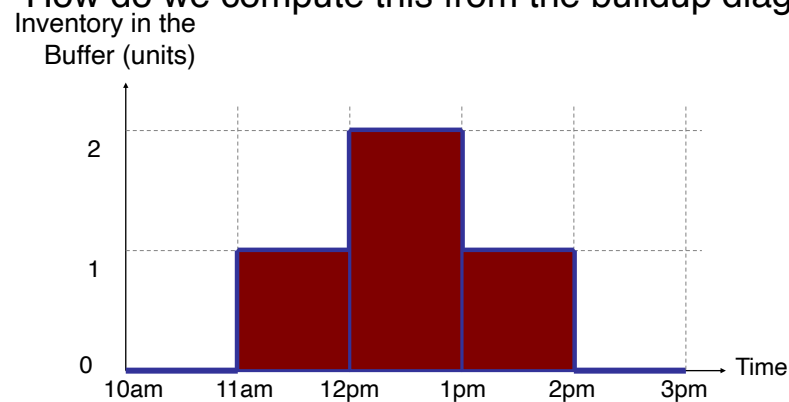
- Demand < Capacity
- Inventory deplete rate = Capacity - Demand
- Throughput rate = Capacity rate



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Waiting Time

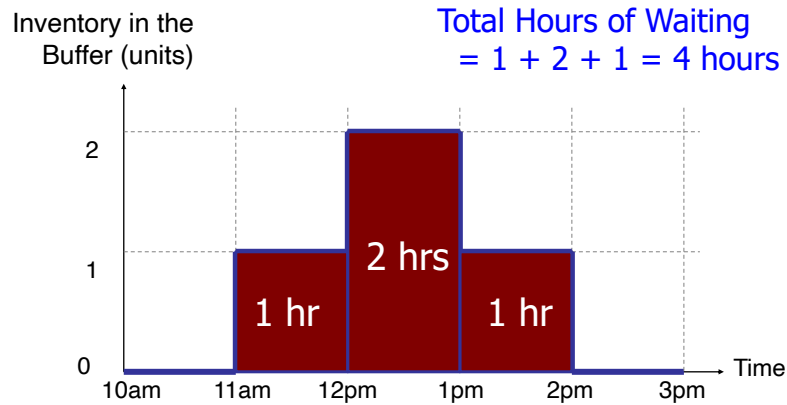
- As the manager, I am interested in knowing total customer hours spent in waiting.
- How do we compute this from the buildup diagram?



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Waiting Time as Area Under Curve



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Waiting Time

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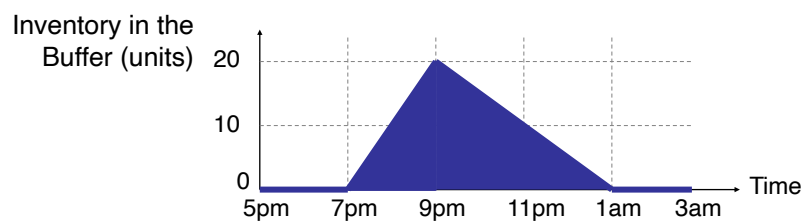
Area under the curve!

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Inventory Buildup Diagram

- As the manager, I am interested in knowing total customer hours spent in waiting.
- How do we compute this from the buildup diagram?



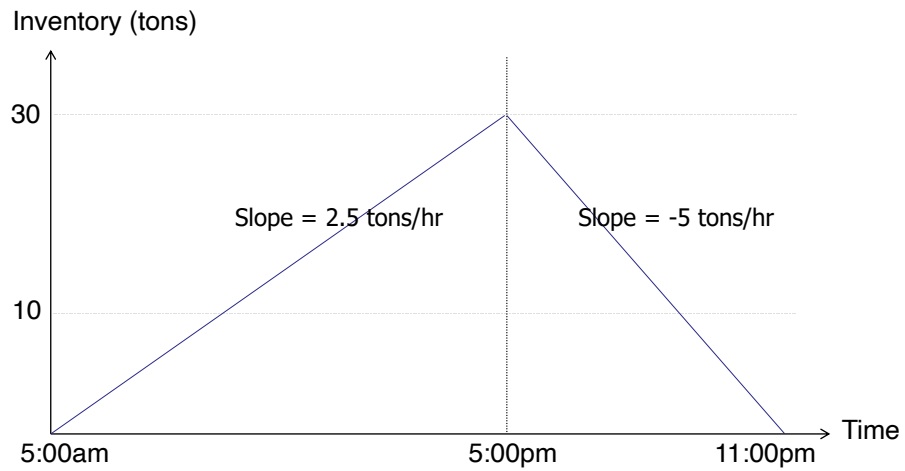
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Practice Problem

- Gary manages a receiving station for peanuts. Farmers deliver their loads of peanuts from 5 am to 5 pm. Gary can process them at a rate of 5 tons an hour, and on a heavy day, a total of 90 tons can be expected.
- Draw the inventory buildup diagram. Assume that the peanuts arrive at the station at an even pace all day.
- The station has room to hold only 10 tons of peanuts in raw material inventory prior to processing. Once this space is filled, the farmers' trucks must wait (cannot come to (Gary's station) dump their contents).
- At what time will the trucks likely start to wait to unload?

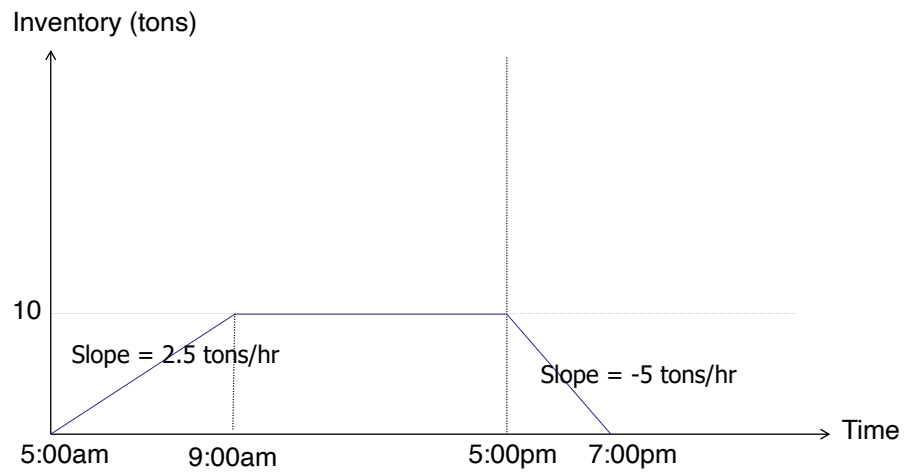
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Practice Problem



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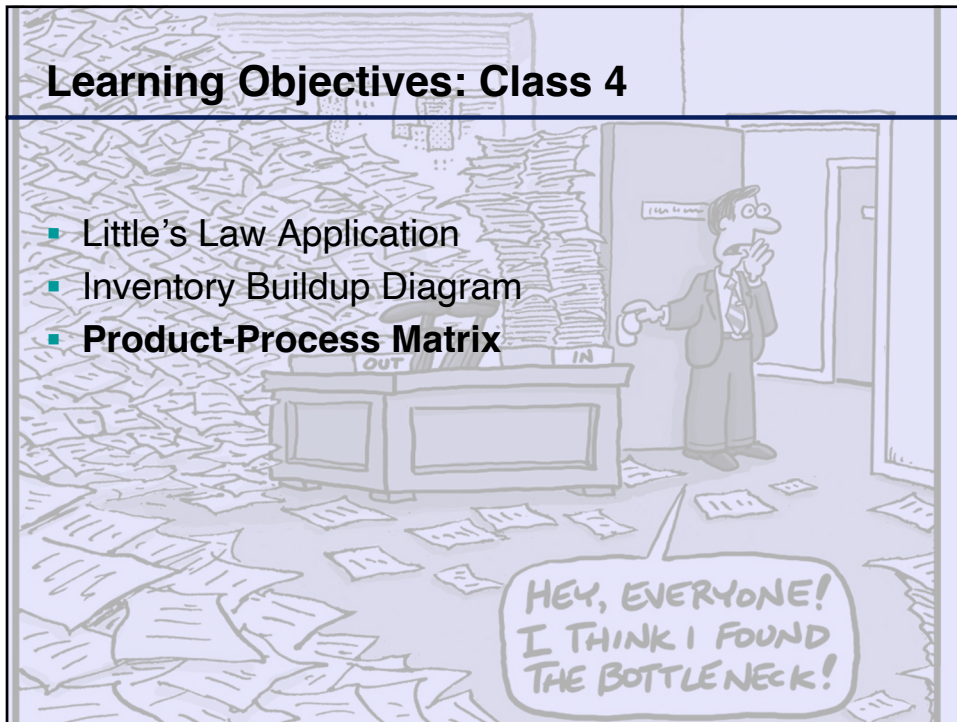
Practice Problem



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Learning Objectives: Class 4

- Little's Law Application
- Inventory Buildup Diagram
- **Product-Process Matrix**

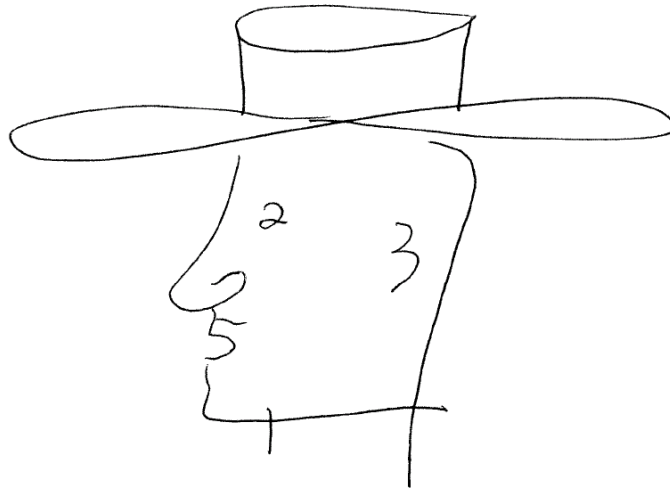


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8 → 1 → 9 → 6 → 5 → 4 → 2 → 3 → 7



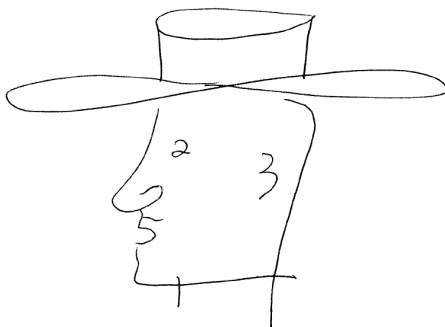
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Product A

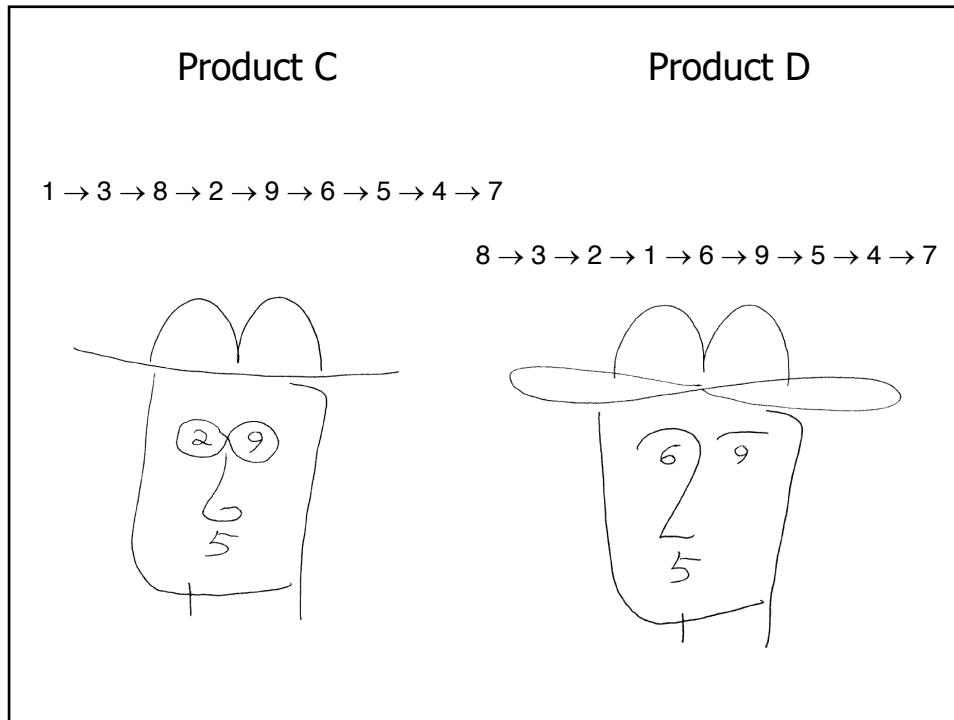
Product B

8 → 1 → 9 → 6 → 5 → 4 → 2 → 3 → 7

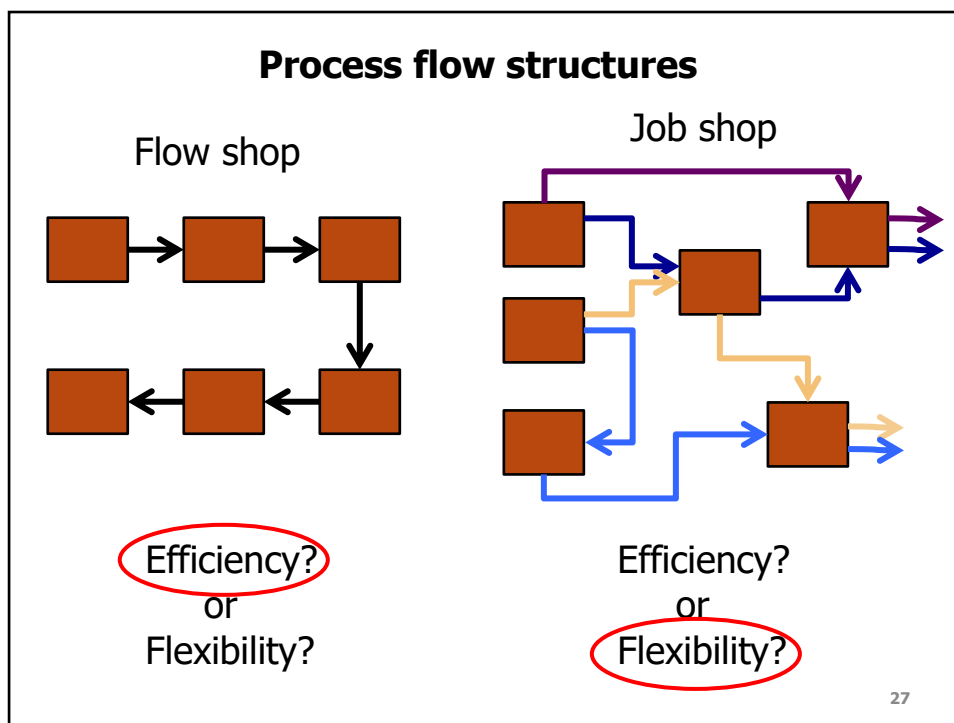
9 → 6 → 5 → 4 → 8 → 2 → 1 → 3 → 7



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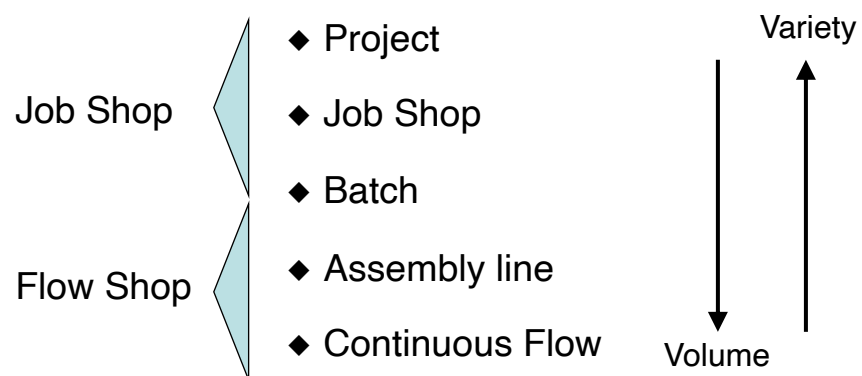
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Job Shop vs. Flow Shop

Type of Process	Product Volume	Equipment Specialization	Product Variety	Machine Setup Frequency	Labor Skills	Variable Cost
Job Shop	Low	Low	High	High	High	High
Flow Shop	High	High	Low	Low	Low	Low

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Taxonomy of Process Flow Structures



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Product-Process Matrix

Product / Process		One of a kind	Low Volume Customized Products	Medium Volume High Variety	High Volume Standard Products	Very High Volume Commodity Products
Job shop	Project					
	Job shop					
	Batch					
Flow shop	Assembly line					
	Continuous flow					

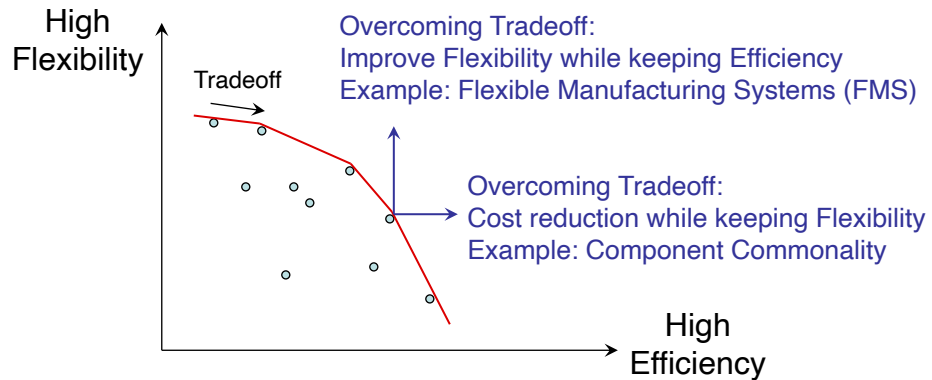
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Product-Process Matrix

Product / Process		One of a kind	Low Volume Customized Products	Medium Volume High Variety	High Volume Standard Products	Very High Volume Commodity Products
Job shop	Project	Spaceship			High Variable Costs Lost Sales	
	Job shop		Ferrari			
	Batch			Jeans		
Flow shop	Assembly line	High Capital Costs Low Utilization			Ford automobiles	
	Continuous flow					Petroleum refining

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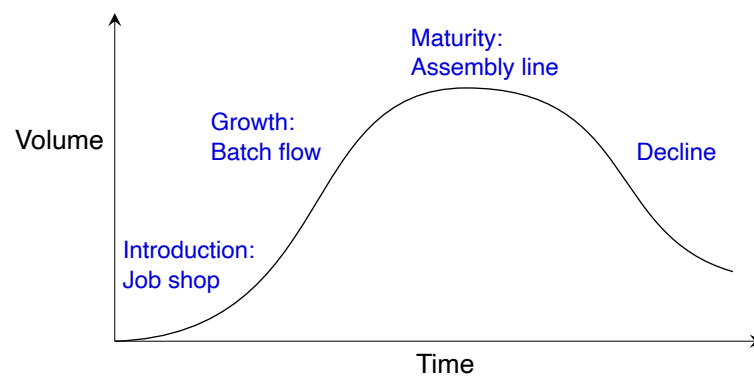
Flexibility-Efficiency Tradeoff



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Product and Process Life Cycles

- Marketing and operational decisions



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Lessons

- Match process to product
- Match process to product throughout the product's life cycle