Module Five

Logistics Course for Public Sector Freight Planners

Mississippi Valley Freight Coalition

National Center for Freight and Infrastructure Research and Education (CFIRE)

University of Wisconsin-Madison

Outline

- Supply Chain Strategies
- Logistics Network Design
- Procurement and Outsourcing
- Information Technology in Logistics
- Concluding Remarks

Supply Chain Strategies

Objectives of Supply Chain Strategies

To Reduce Total Cost Through

- Reducing the time from manufacturing to consumption, reducing redundant inventory in the supply chain;
- Facilitating smooth flow of products, raw materials, finance, information, technology between parties through partnership and cooperation;
- Improving system integration and system resiliency.

Logistics Cost as a Percentage of GDP

Country	GDP %
USA	10.5
Canada	12
UK	10.63
Denmark	12.88
Ireland	14.26
Spain	11.52
Hong Kong	13.71
Japan	11.37

Source: Financial Times, December 1998

Logistics Cost Breakdown in USA

Cost	Percentage
Transport	46
Storage/Warehousing	22
Inventory Carrying	22
administration	10

Cited in the Handbook of Logistics and Distribution Management.
Source: Financial Times, December 1998.

Cost Itemization as a Percentage of Final Sales Turnover

Main Business	Transport Cost	Warehousing /Depot	Inventory Holding	Administration	Overall
Office Equipment	3.2	**10.7**	0.87		14.77
Health Supply	1.36	**9.77**	0.66	0.19	11.98
Beer	8.16	2.82	0.56	2.19	13.74
fashion	0.38	1.31	0.33		2.02
Cement	**25.2**	9.1	**7.1**	4.6	**46**
Auto Parts	2.07	6.35	1.53		9.96
Computer Supply	0.65	0.78	0.09		1.52

Source: Benchmark Survey of UK Companies by Dialog Consultants Ltd. Cited in Handbook of Logistics and Distribution Management by Rushton, Oxley and Croucher, 2000.

Inventory Policies

- (s, S) Ordering Policy
  - Continuous Review
  - Periodic Review
- Economic Order Quantity (EOQ) Model
  – Most Basic Model

$$Q^* = \sqrt{\frac{2KD}{h}}$$

D = Demand; K = fixed ordering cost; h = inventory carrying cost

Example for EOQ

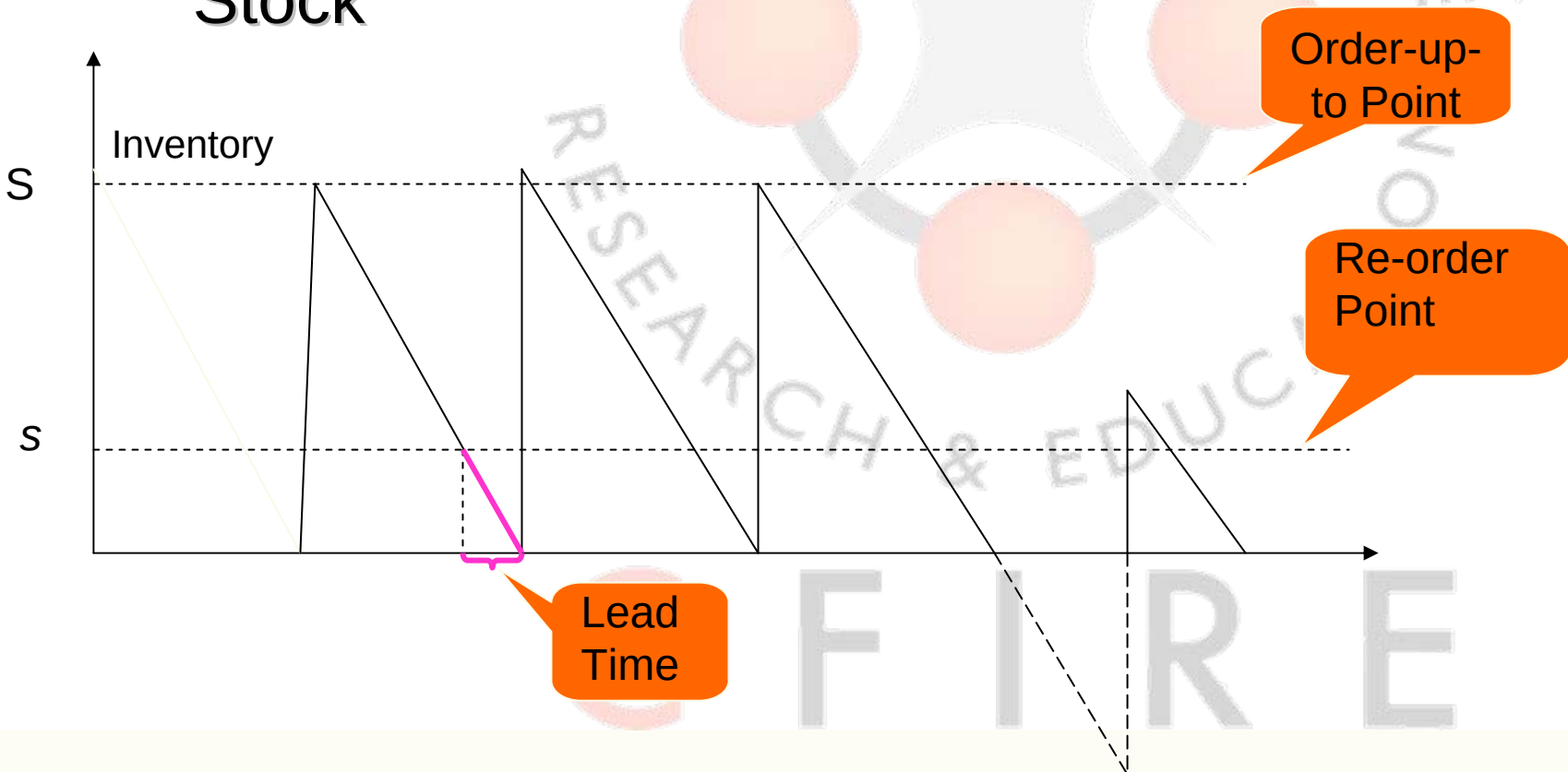
- ***Example*** A distribution center (DC) manages distribution of a product. The unit value of this product (purchase cost) is $50.00. The annual demand for this product that goes through the DC is 4000 units. The cost of placing an order each time is $400. If the inventory carrying cost is 20% of the tied inventory value, how many units shall be ordered each time?
- ***Solution***

  Here D=4000; K=400; h=$50x20%=$10.00.
  Therefore,

$$Q^* = \sqrt{\frac{2KD}{h}} = \sqrt{\frac{2*400*4000}{10}} \approx 568.$$

Impact of Transportation On Inventory Management

- Longer In-transit Time Raises Re-order Point
- Transit Time Reliability Affects Safety Stock



Implications of Uncertain Lead Time to Inventory

Time Reliability Cost to Inventory (A)

Suppose that an inventory policy is needed for a consumer product. Assume that whenever an order is placed for replenishment, an ordering cost is incurred of $4,500, which is independent of the order size. Each unit of product has a cost of $250, and the annual inventory cost is 18% of the product cost. Lead time (from order placing to order arrival) is about two weeks. We have the following data and optimal policy to manage the inventory.

Average weekly demand	Standard deviation of weekly demand	average demand during lead time	reorder point	Safety stock	order quantity
44.58	32.08	89.16	176	86.2	679

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Time Reliability (Lead Time Variance) to Optimal Inventory Cost (B)

Standard Deviation (in days)	Re-order Point (units)	Inventory increase
2	179	0.78%
3	183	1.72%
4	188	2.97%
5	194	4.49%
6	202	6.23%
7	210	8.14%
8	219	10.20%
9	228	12.38%

Note: order quantity remains the same.

Source: Formula from Designing and Managing the Supply Chain by Simchi-Levi, etc.

Lead Time Duration to Inventory Cost

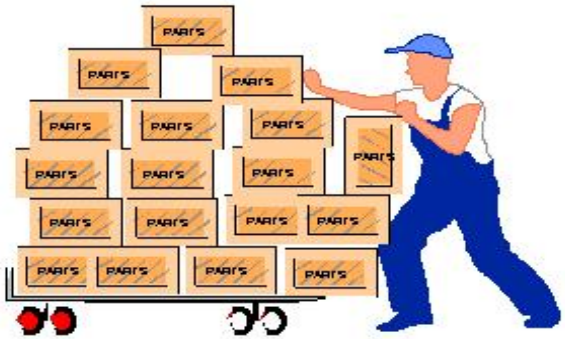
New Lead Time (day)	Demand During Lead Time	Safety Stock	Re-order Point	Average Inventory Change
24	153	113	266	6.26%
23	146	110	257	5.70%
22	140	108	248	5.13%
21	134	106	239	4.55%
20	127	103	230	3.95%
19	121	100	221	3.34%
18	115	98	212	2.71%
17	108	95	203	2.06%
16	102	92	194	1.40%
15	96	89	185	0.71%
14	**89**	**86**	**175**	**0.00%**
13	83	83	166	-0.74%
12	76	80	156	-1.50%
11	70	76	146	-2.30%
10	64	73	137	-3.14%

Additional Supply Chain Strategies

Pull vs Push Systems

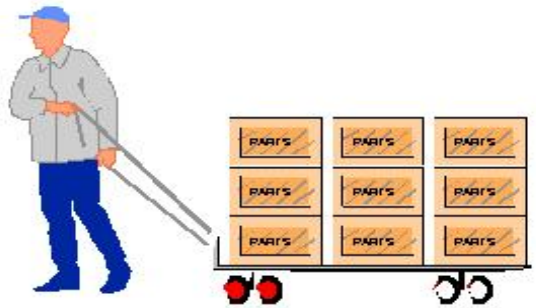
Push vs. Pull

Make all we can just in case.



- Production ¯pproximation
- Anticipated Usage's
- Large Lots
- High Inventories
- Waste
- Management by Firefighting
- Poor Communication

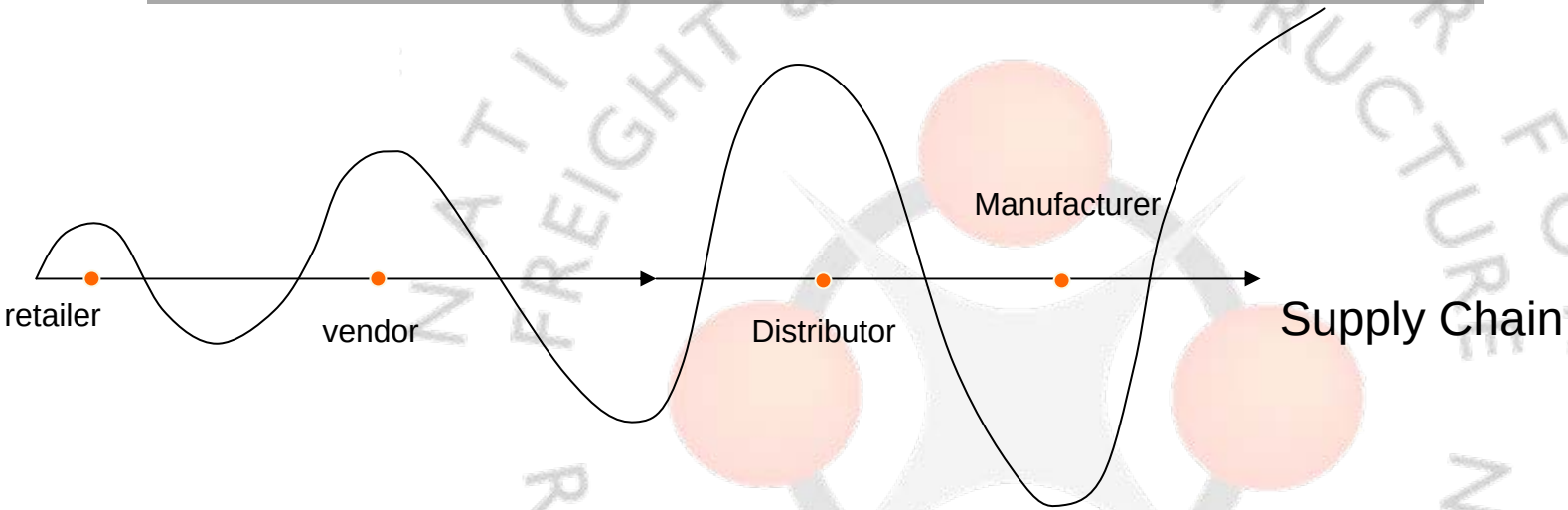
Make what's needed when we need it



- Production Precision
- Actual Consumption
- Small Lots
- Low Inventories
- Waste Reduction
- Management by Sight
- Better Communication

Source: http://elsmar.com/Pull_Systems/. Accessed on September 10, 2007

The Push System: Bullwhip Effect



- Other Disadvantages of a Push System
  - The inability to meet changing demand patterns
  - The likely obsolescence of supply chain inventory as demand for certain products disappears.

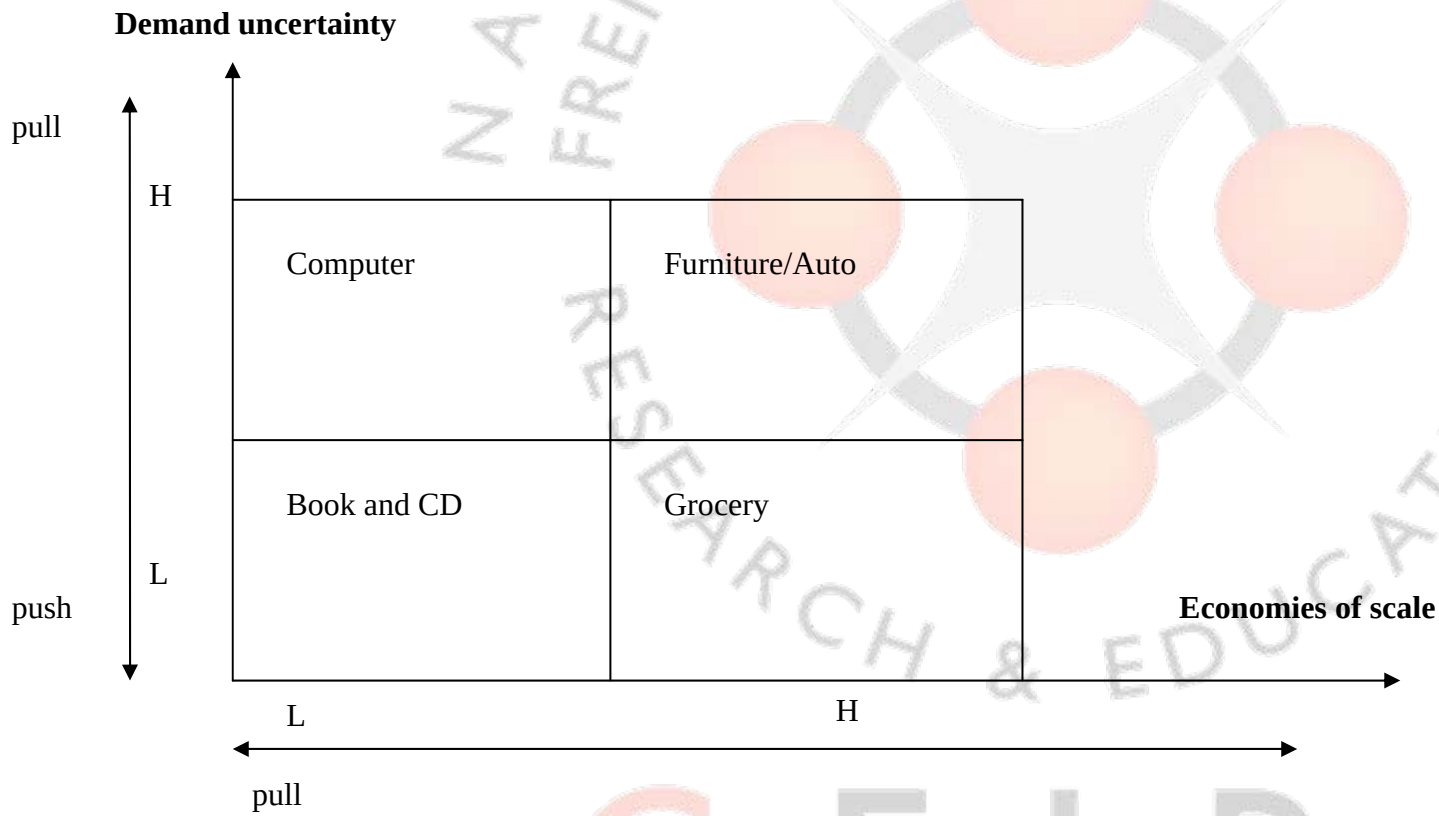
A Pull System

- A Pull System Allows
  - Production and distribution decisions made based on customer demand;
  - Consumption or demand information flows backward along the supply chain.
- Advantages
  - Lower inventory
  - Responsiveness

Example of a Pull System: Demand Driven Dispatch in the Airlines Industry

- Demands Are Air Passengers/Air Cargoes.
- Supplies Are Aircraft Capacity.
- Condition: Air Fleet Is Given.
- Demand Driven Dispatch (D^3) Operations
  - Flexible air fleet assignment with cockpit compatible aircraft swap opportunity imbedded.
  - Realized demand decides the final aircraft assignment (supply of capacity, or production of consumables)

Push vs. Pull systems



Source: Designing and Managing the Supply Chain by Simchi Levi et al. 2000

Vendor Managed Inventory (VMI) System

- Under VMI, instead of the customer monitoring its sales and inventory for the purpose of triggering replenishment orders, the vendor assumes responsibility for these activities

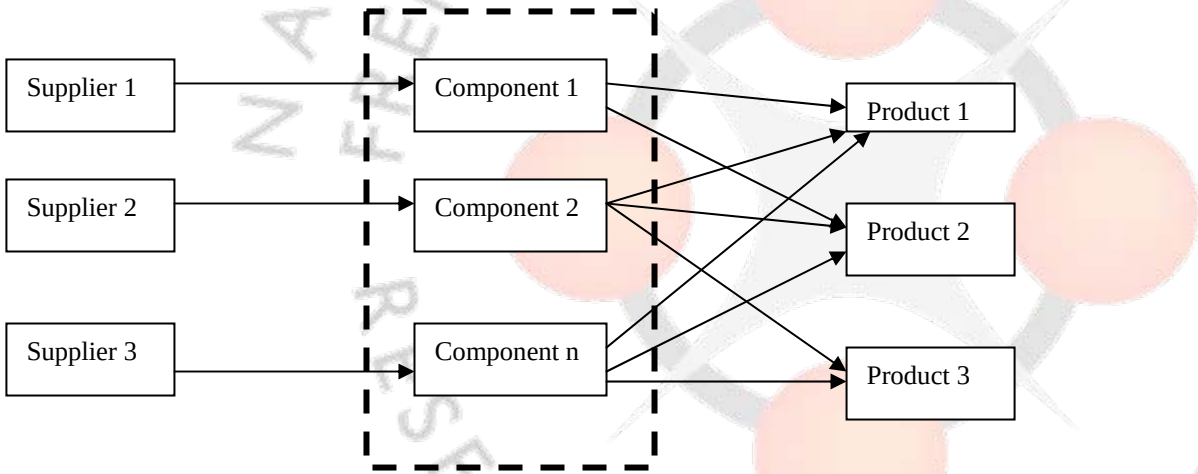
Advantages of VMI

- Improved customer service
- Reduced demand uncertainty
- Reduced inventory requirements
- Reduced costs

Transportation implications: more frequent LTL movements

Assemble-to-order system

- Components Ordered
- Product not Assembled until Order Arrives
- Application Condition
  - Plethora of products sharing the same set of components with different configurations.
  - Demand for each product is uncertain
  - Examples
    - PC Industry
    - Stain mixture

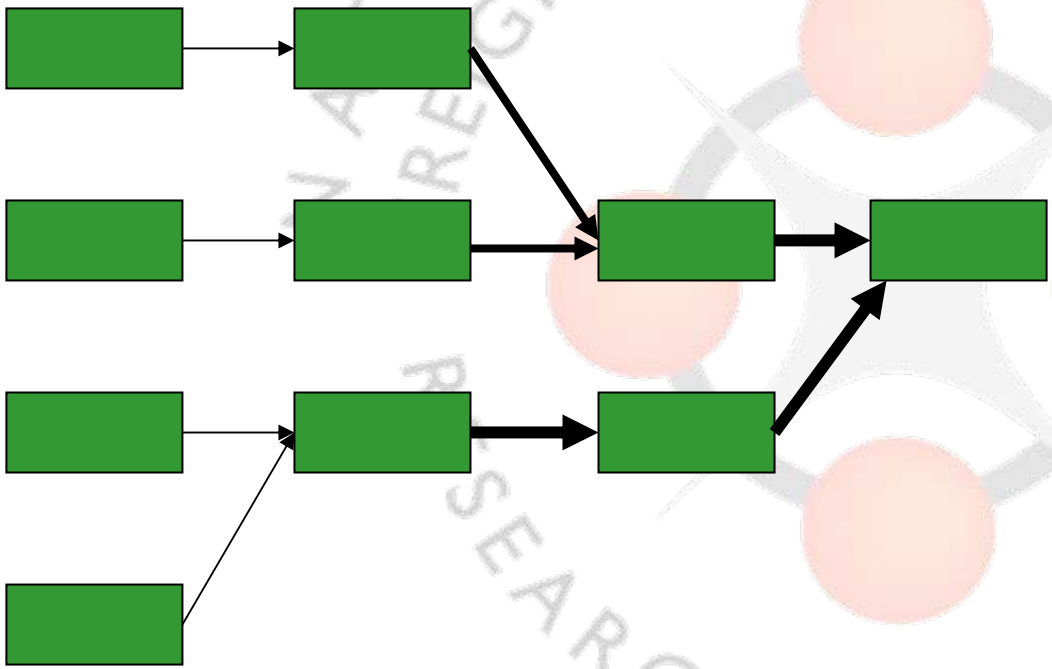


An Assemble to Order System

Just-In-Time System

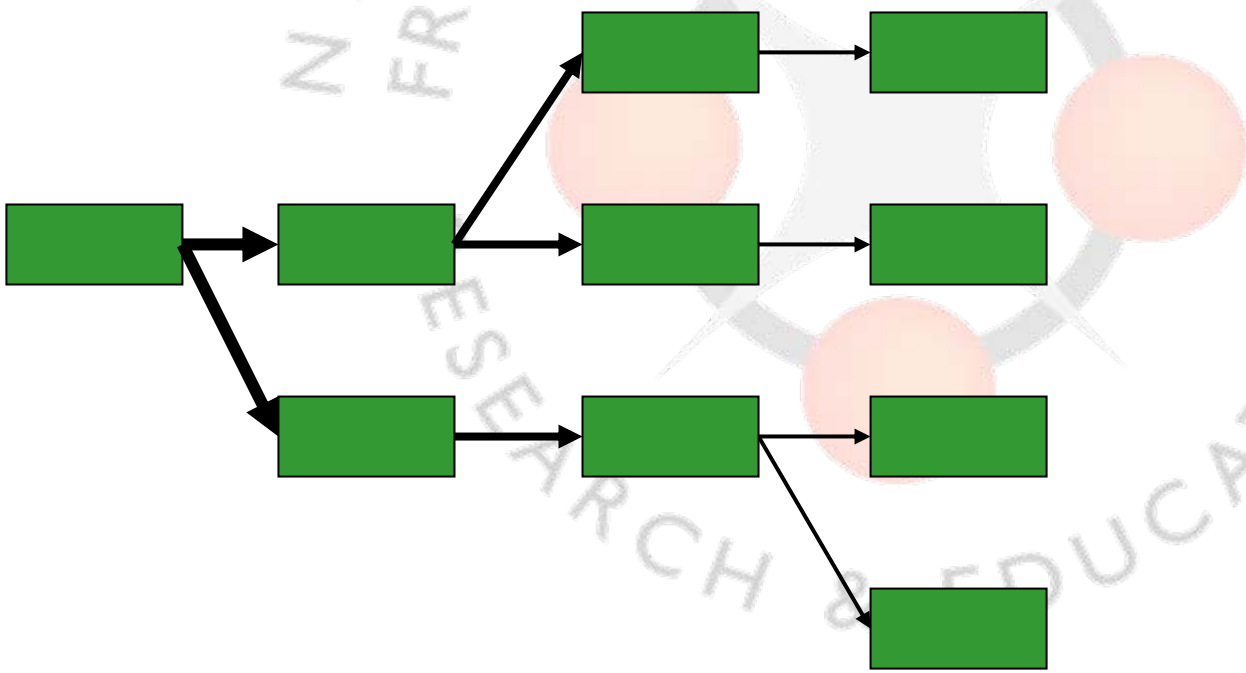
- JIT demands timely, but not too early, supply of needed materials for production in just the right quantity.
- It views inventory as a cost and redundant
- Inventory needed is reduced to the minimum
- It imposes high standard onto products quality (no backup in the inventory!)

Multi-echelon System: An Example of Production



An assembly system

Multi-echelon System: An Example of Distribution



Summary of Supply Chain Strategies

- Major Means of SCS
  - Information sharing (supply and demand)
  - Coordination of supply to match demand patterns
  - Partnership between the manufacturers, distributors and vendors
  - Final consumers are the demand!
- Transportation As a Major Factor in SCS!