HW1 posted → Due: Thursday, Jan. 17th

Continued... Scheduling

\[ J_1, J_2, \ldots, J_n \]

Translates into scheduling \( n \) jobs on different \( W \) working environments.

Supply chain mgmt

Purchase

\[ \text{Inventory control} \]

1. How many do we purchase?
2. Order frequency

How do we make the entire system efficient/effective?

⇒ More lean
⇒ To realize a win/win situation for everyone involved
Chapter 11
Supply Chain Inventory Mgmt.

Inventory
Inv. may be considered an accumulation of a commodity that will be used to satisfy some future demand for that commodity.

Types of inventories
1. Raw materials
   The resources that are used in producing a product.

2. Components
   Items that have not yet reached the completion in the production process (also called parts or even subassemblies).

3. Work-in-process (WIP)
   Items that are waiting to be processed or are currently processed (includes components and even raw materials).

4. Finished goods
   The final products of the production process (also known as end items).
In particular, independent demand inventory management focuses on inventories of materials such as:
- Finished goods in manufacturing and service operations
- Spare parts in maintenance shops
- Purchased products in retailing
- Purchased supplies in service shops

Why? Because the demand for these items is primarily influenced by factors that are independent of the company’s decisions.

Is there something called dependent demand inventory systems?
Yes!
Example: # of tires required to produce 200 cars

- 4x200 regular tires
- 200 spare tires

For dependent demand, inventories techniques such as MRP and JIT are best suited.
Reasons for holding inventories

1. Economies of scale/spreading the fixed costs of purchasing or setups.  
   \[ \Rightarrow \text{The larger the qty purchased/produced per order, the smaller the fixed cost/unit} \]

2. Decoupling of production

3. Uncertainties \([\text{called safety stock (ss)}]\)
   \(\text{Inv. provides a buffer against the uncertainty of demand and/or lead time}\)

4. Smoothing and stabilizing production  \(\Rightarrow \text{low demand: } P > D \Rightarrow \text{inventories of the product increase}\)
   \(\Rightarrow \text{high demand: } D > P \Rightarrow \text{inventories are depleted}\)
5. Speculation \( \rightarrow \) called \textit{anticipatory stock}

Speculative inventories are held to protect against unusual events or to take advantage of unusual opportunities.

- Workers expected to go on strike at a supplier firm.
- Price of raw material is expected to increase in the near future.

6. \textit{Transportation} \( \rightarrow \) called \textit{pipeline inventories}

If \textit{transportation} times are significant, in-transit or pipeline inventories would be carried.

- Has been the motivating factor for some companies to establish production or\textit{suppliers} locally.

**Measuring inventory performance** $400,000

\[
\text{Inventory turnover} = \frac{\text{Annual sales volume}}{\text{Average investment on inventory during that year}}
\]

\[ IT = 15 \]
Higher the inventory turnover, the greater is the return on investment (ROI) on inventory.

Abernathy et al. (1985)

Toyota's 2-card Kanban system

Costs

1. Order cost/order prep cost (also called setup cost)
   - Clerical/bookkeeping expense associated with the order
   - Fixed costs that might be required by the vendor
   - Delivery/transportation cost
   (independent of the size of the order)

2. Inventory carrying/holding cost
   - Cost of providing the physical space to store the items
   - Taxes and insurance
   - Breakage, spoilage, deterioration, and obsolescence
   - Opportunity cost of alternative investment ⇒ cost of capital

\[ \text{Inventory value} \leq 28\% \times \text{inventory value} \]
(3) Shortage/penalty cost

demand > supply \Rightarrow shortage.

Shortage can lead to:
- lost sales
- backorder (customer is prepared to wait)

In the lost sales case,
shortage cost = lost profit

In the backorder case, shortage cost = bookkeeping and/or delay costs that might be involved.

Note: In both cases, the goodwill lost cost is not included.

Customer service level \rightarrow (SL)

(1) \% shipped directly from inventory

- Ex: 450 out of 500 units demanded have been supplied directly from inventory \Rightarrow SL = \frac{450 \times 100}{500} = 90\%

(2) \% of order cycles (replenishment) in which \textit{more} units had to be backordered.
ex: 1 out of 10 cycles we had to backorder 1 or more (>1) units.

$$SL = \frac{9}{10} \times 100 = 90\%$$