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Inventory Management

Functions, Costs and KPIs

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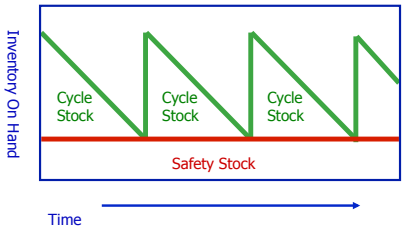
Inventory functions

- Cover process time
- Allow for uncoupling of processes
- Anticipation / Speculation
- Minimize control costs
- Buffer against uncertainties
  - Demand
  - Supply
  - Delivery
  - Manufacturing/Processing

Classification of Inventory

Conventionally, the ***production stock*** identifies those items that contribute to producing or forming the product output of the company:
Raw Materials, WIP, Components/Assemblies, Finished Goods

- Functional Stock
  - Cycle Stock
  - Pipeline Inventory (in transit)
- Safety Stock
- Speculative Stock



Inventory and performance

Inventory Level

Low

- Inventory costs (reduction)

High

- Service Level (encrease)
- Resource leveling (encrease)
- Set up number (reduction)
- Resource utilization (encrease)
- Order costs (reduction)
- Transport costs (reduction)

Performance Indicators - KPIs

The numerator and denominator must be congruent

Inventory Turn

$$IT = \frac{Cost\ of\ goods\ sold}{Average\ inventory\ value}$$

(A measure of the expected number of times inventory is replaced over a year)

Days-of-supply

$$DS = \frac{Working\ days}{IT}$$

(The number of days of inventory of an item

is the inverse of inventory turn scaled to days)

Performance Indicators - KPIs

Service Level - examples

$$OTO = \frac{\#\ of\ Orders\ Delivered\ On\ Time}{Total\ \#\ of\ Orders}$$

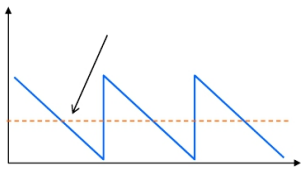
On Time Orders
The percentage of the time that customers receive their orders on time

$$SO = \frac{\#\ items\ out\ of\ stock}{\#\ items\ shipped}$$

Stock-outs, or **out-of-stock items**
The percentage of items not available in inventory when a customer places an order

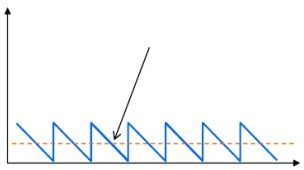
Case 1 – Inventory Turn (quantity-based) without Safety Stock (SS)

Item A
Demand: 40 u/month
Replenishment period: month
Batch: 40 u
AvINV = 20 u



ITQ_A= 40 x 12 / 20 = 24 (1/year)

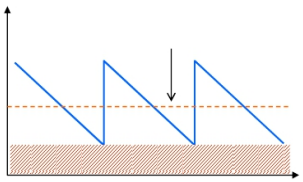
Item B
Demand: 40 u/month
Replenishment period: week
Batch: 10 u
AvINV = 5 u



ITQ_B= 40 x 12 / 5 = 96 (1/year)

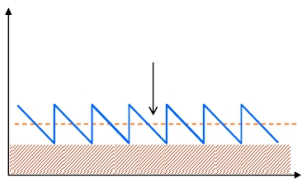
Case 1 – Inventory Turn (quantity-based) with Safety Stock (SS)

Item A
Demand: 40 u/month
Replenishment period: month
Batch: 40 u
SS: 5 u
AvINV = 25 u



ITQ_A= 40 x 12 / 25 = 19,2 (1/year)

Item B
Demand: 40 u/month
Replenishment period: week
Batch: 10 u
SS: 5 u
AvINV = 10 u



ITQ_B= 40 x 12 / 10 = 48 (1/year)

Relevant Cost in Inventory Management

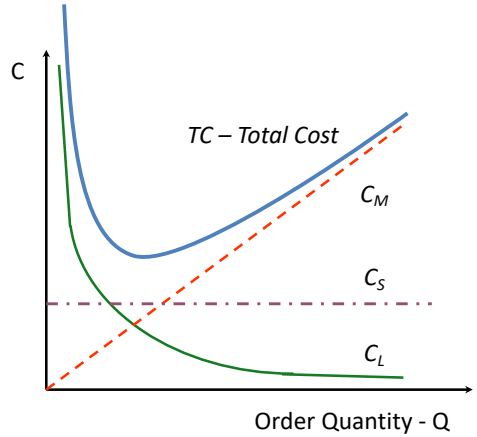
- Purchase Cost (unit value)
- Ordering Cost (set-up: cost to place, receive and process a batch; invoicing, auditing (QA), labour)
- Holding Cost
  - Storage costs (warehouse space, facilities, internal transport, personnel, handling, insurance)
  - Risk costs (lost, stolen, damaged, obsolete)
  - Capital costs (cost of capital, taxes, hurdle rate)
- Shortage Cost (or stock-out)

Trade-off between benefits of stock and inventory costs

Shortage Cost

- Shortage (Stock-Out) Cost
  - [€/unit, €/unit/time, €/order]
- What does it contain?
- Cost of not having an item in stock
  - Backorder – customer will wait for item
  - Lost Sales – customer goes elsewhere (fill or kill)
  - Lost Customer Sales–customer goes away forever
  - Disruption Costs – holds up production line
- When is it relevant?
  - Whenever there is uncertainty in demand, replenishment time, etc.

Order Quantity and Costs



C_M, cost items that increase as average stock increases (storage costs, risk costs, cost of capital,...)

C_L, cost items that decrease as average stock increases (order issuing costs, transport costs, quality control in acceptance,...)

C_S, cost of safety stock, including storage and shortage costs

Which costs are relevant?

Summary

- Explain how inventory is used
- Measure inventory management performance
- Understand what inventory costs

- References:
  Ch. 20 Jacobs, Chase